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**THEORY OF MIND AND SOCIAL SKILLS IN
CHILDREN WITH AUTISTIC SPECTRUM DISORDERS**

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ABSTRACT

Impairment in social interaction is one of the defining characteristics of autistic-spectrum disorders. Three factors that may influence the pattern of social skills deficits in autistic individuals are explored in the present study.

1. Can the autistic individual pass theory of mind tasks? Baron-Cohen, Leslie and Frith (1985) suggested that the core impairments of autism could be explained by an inability to attribute mental states to oneself and others. The term “theory of mind” is used to refer to this ability to represent mental states.
2. Does the autistic individual use logical/factual or mentalist strategies to solve theory of mind tasks? Happé (1994) suggested that if success on theory of mind tasks was due to the use of a logical strategy, this would explain why these individuals were still socially impaired. The underlying reasoning strategy about social situations may have an influence on everyday social interactions.
3. Is general social reasoning influencing theory of mind task performance and achievement of everyday social skills? Several suggestions have been made as to possible reasoning strategies that may be used by children with autistic spectrum disorders to solve theory of mind tasks or to circumvent a lack of theory of mind ability in everyday life.

Children with high-functioning autism/Asperger’s Syndrome were tested with a battery of theory of mind tasks (1st and 2nd order) and social reasoning tasks. Their performance on these tasks was compared to their everyday social skills as assessed by the Vineland Adaptive Behavior Scales (Sparrow et al, 1984) and other parent-rated questionnaires. Results were reported and discussed in the context of the

relevant literature. The effects of theory of mind ability, social reasoning skills and the central drive for coherence on the everyday social skills of autistic children were discussed. Implications for clinical interventions for social skills deficits in children with autistic-spectrum disorders were discussed.

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CHAPTER 1: INTRODUCTION

1.1 Organisation of Introduction

The introduction to this thesis begins with a brief description of autism and Asperger's syndrome and how they are related in the spectrum of autistic disorders. The social impairments characteristic of autistic-spectrum disorders are then reviewed, with reference to the theory of mind hypothesis where appropriate, as it is these that the "Theory of Mind" and other hypotheses seek to explain. The next sections define theory of mind and describe the background to the hypothesis, as well as reviewing empirical evidence supporting and conflicting with the theory of mind deficit account of autism. Other hypotheses seeking to explain the pattern of social skills and deficits in autism, such as alternative strategies for passing theory of mind tasks or a tendency to focus on the separate parts rather than the integrated whole (weak central coherence), are then described. Social reasoning is briefly reviewed. The relationship between theory of mind, the use of mental state language, social reasoning and everyday social behaviour is then discussed. Finally, the aims and hypotheses derived from the previous research described in this introduction are presented.

1.2 The Autistic Spectrum

The first description of autism as a distinct disorder was provided by Kanner in 1943. He described a group of children with a set of key behavioural features, including communication impairments and "autistic aloneness". Just one year later, Asperger published independently a description of "autistic psychopathy" in childhood (Asperger, 1944; reprinted and translated in Frith, 1991). These two syndromes

involved many similar features and both emphasised the child's social impairments as characteristic of the disorder. Later observations confirmed three core deficits that were present in nearly all autistic individuals:

- a general failure to develop social relationships and specific impairments in social interactions,
- absence or impairment of verbal and non-verbal forms of communication,
- absence or impairment of imagination, and repetitive, stereotyped activity.

Since the first publications in the 1940's, there has been a debate about whether Kanner's 'classic' autism and Asperger's syndrome are descriptions of the same disorder, entirely different disorders, or two points on a spectrum of autistic features (e.g. Bowler, 1992; Wing & Gould, 1979). Early discussions on the nature of the relationship between Asperger's and Kanner's syndromes recognised some link between the two conditions while maintaining they were distinct disorders (e.g. Asperger, 1979; Van Krevelen, 1971). Those who argue for two distinct syndromes generally consider Asperger's syndrome to be a form of personality disorder (Nagy & Szatmari, 1986; Wolff & Chick, 1980), and Kanner's autism to be a developmental disorder (Wolff & Chick, 1980) or a form of psychosis (Kay & Kolvin, 1987).

Some children with characteristic features of Kanner's autism in early childhood later develop language and social skills and cognitive abilities within the average range. These children are often labelled with the term high-functioning autism. There were some, mainly clinicians, who saw close similarities between Asperger's

syndrome and high-functioning autism in terms of clinical presentation and behavioural features (Schopler, 1985). Common to both disorders are impairments in social functioning and imagination, as well as the absence of joint attention behaviours (see Section 1.3 for definition). The majority of children with autistic syndromes have significant learning disabilities, but children with any level of intellectual ability can have autism (Wing & Gould, 1979). DeLong & Dwyer (1988) suggested that the boundary between Kanner's and Asperger's syndromes was between high- and low-functioning individuals: high-functioning autism and Asperger's syndrome being equivalent disorders distinct from low-functioning autism on the basis of presence or absence of learning disability.

The existence of impairments common and central to both Kanner's and Asperger's autism suggests a shared underlying pathology. It was Wing and Gould (1979) who first described the concept of an autistic spectrum. They argued that autistic individuals could present differing degrees of impairment on the dimensions of socialisation, communication, imaginative activity and other psychological and physical functions, but that all show impairment in reciprocal social interactions. This idea implies that people with Asperger's syndrome and Kanner's syndrome of 'classic' autism represent subsets of a larger population of people with social impairment, with Asperger's syndrome and high-functioning autism showing less global intellectual impairment and less impaired language skills than classic (Kanner's) autism. The findings from genetic studies that autism is most likely to be due to a combined effect of several different genes rather than a single genetic factor

(e.g. Pickles, Bolton, MacDonald, Bailey, Le Couteur, Sim & Rutter, 1995) only adds weight to the autistic spectrum hypothesis.

Syndrome delineation has been just one of several fields of research into autism since its first description. The aetiology of the disorder, the psychological and behavioural nature of autism and clinical interventions have also been foci of research. In particular, the pattern of social skills and deficits and their underlying cause(s) has been the focus of more recent research, as the need for interventions that produce developmental gains has increased (Rutter, 1999). One of the most important areas of debate that has come to the fore since the 1980's has centred on the "Theory of Mind" deficit account of autism. Briefly, this theory postulates that social impairments in autism arise from a lack of awareness of what other people may be thinking. Before describing this theory of a cognitive deficit underlying autism, the specific nature of social and communicative abilities and deficits in autism should be examined, as the relationship between Theory of Mind and social behaviour is the focus of the current study.

1.3 Social Behaviour in Autism

There are numerous behaviours that have been included in the definition of social skills. The Vineland Adaptive Behavior Scales (Sparrow, Balla & Cicchetti, 1984), for example, a widely used measure of social behaviour, includes sections on self-care and motor skills. For the purposes of this study, the behaviours included in the definition of social behaviour are limited to interpersonal behaviours, such as relationships, conversation skills and conflict avoidance skills.

Social behaviour is important for all aspects of life for children and affects their later adjustment and happiness (Matson & Ollendick, 1988). A child with good social adaptation skills will benefit from improved relationships, the ability to solve social problems (and thus the ability to avoid conflict) and may also benefit from secondary gains such as reward and approval from others (Kelly, 1982). In contrast, poor social skills in early life will impede the quality and quantity of early social experiences and prevent the learning and development of further social skills in a vicious circle with serious long-term consequences (Bierman & Furman, 1984).

This following section on the social behaviour of autistic individuals begins with information on general patterns of social behaviour and early social responsiveness. As “social behaviour” could potentially include a very wide range of topics, the following segments are limited to the broad categories of interpersonal social behaviour that are included in the main social skills measure used in this study, the Vineland Adaptive Behavior Scales (Sparrow et al, 1984).

General Patterns of Social Behaviour

Wing & Gould (1979) described three types of general social impairment found in the children in their epidemiological study. While some of the children demonstrated the “autistic aloneness” of Kanner and avoided most social contact, others would not initiate social contact but would passively accept other people’s social approaches. The third group of socially impaired children would initiate social contact but the interaction would be idiosyncratic and repetitive. Social impairment, rather than language impairments or repetitive activities, distinguished children with autistic

spectrum disorders from children with general learning disabilities and normal children (Wing & Gould, 1979).

Thus, impairment in social interaction is one of the defining characteristics of autistic spectrum disorders. However, the impairment is not uniform. Across the range of social behaviours in autistic children, some are preserved, some are impaired and some appear to develop at a later stage than in non-autistic children, with variations between individuals.

Attachment

Little direct information about early social behaviour patterns in autistic infants is available as diagnosis is not usually made before the second year. Information about early social responsiveness in children with autistic spectrum disorders is therefore mainly retrospective. However, several studies have explored early social relationships between autistic children and their caregivers (albeit at a later stage than with normal children) using the 'strange situation' paradigm. The 'strange situation' paradigm involves an infant being left briefly by their caregiver in an unfamiliar environment and the response to this disappearance and the reappearance of the caregiver is monitored. Non-autistic, securely attached children (at about 12-24 months old) may or may not be distressed by their caregiver's absence but all seek contact with them on their return. Between 40% to 70% of normal children will show this secure attachment response (Smith & Cowie, 1988).

Autistic children of three- to four-years-old also showed evidence of secure attachment relationships in the 'strange situation', although the responses tended to be less intense than those of normal children of the same developmental level (Capps, Sigman & Mundy, 1994; Rogers, Ozonoff & Maslin-Cole, 1991). However, separation distress usually subsides in normal three- to four-year-olds, so little significance can be placed on autistic children of the same age showing less intense separation responses than younger normal children. About 40% of autistic children appear securely attached to their caregiver, a proportion similar to children with general learning disabilities (Capps, Sigman & Mundy, 1994).

The early attachments of children have been hypothesised to influence the character of later social relationships (Sigman & Capps, 1997). However, secure attachment to a caregiver may be insufficient for the development of relationships in later life: autistic children are as able as children with general learning disabilities to form secure attachments, but, in comparison, fail to develop both the number and quality of such relationships. This also suggests that the deficit underlying autistic social impairments does not impact on social development until a later stage, after initial attachments have been made but before wider social behaviour develops. However, there is some indication that autistic interpersonal social impairments are present before age two (see below).

Joint Attention

Joint attention behaviours are non-verbal communicative acts, such as gestures, to draw another person's attention to an object. The child's intention behind the gesture

may be to get an adult to obtain an object for him/her (protoimperative), or just to point out an object of interest (protodeclarative). The person on the receiving end of the gesture must have some understanding of the intent of the child in order to respond appropriately. Joint attention behaviours normally develop at about nine months of age, but have been shown to be rarely present in the interactions of children with autism (Curcio, 1978). More specifically, it is only the protodeclarative gestures that are missing from an autistic child's communications (Baron-Cohen, 1989a).

Baron-Cohen (1989a) suggested that joint attention deficits reflect an impairment in the understanding of the mental state of attention, and are therefore early indicators of a theory of mind deficit. Mundy, Sigman & Kasari (1993) argued that joint attention behaviours may involve the integration of emotion and cognition, and that integration may aid a child's development of understanding of other people's mental lives. Those autistic children who do show joint attention behaviours are likely to develop better social communication skills than those who do not (Mundy, Sigman & Kasari, 1990). Joint attention behaviours are important to the development of social competence as a whole.

Social Referencing

From approximately nine months old, infants will look at the faces of their caregivers or other people for information. Children will monitor someone's gaze to gather information about *where* they are looking, but also look for information about how they are *feeling* about what they are looking at. In confusing or novel situations, the

infant will look and respond to other people's facial expressions – if the adult appears frightened the infant will withdraw; if the adult appears positive, the infant will advance on the object or situation drawing its attention (Hornik, Risenhoover & Gunnar, 1987). Autistic children are much less likely to look to a caregiver for information about an ambiguous situation, and less likely to respond appropriately if they do, than non-autistic children or children with general learning disabilities (Sigman, Kasari, Kwon & Yirmiya, 1992). This failure to perform social referencing behaviours impedes autistic children in their ability to identify and assume the attitude of another person. Attempting to see a situation the way another person sees it is an important part of learning about and participating in relationships and the social culture as a whole (Tomasello, Kruger & Ratner, 1993). A social referencing deficiency will severely hamper an autistic child's development of social understanding.

Play & Imagination

One of the core deficiencies of autism is a deficit in imagination. Imagination is required for pretend play, where an object may be used as if it was an entirely different object (e.g. pretending a banana is a telephone), or dolls can do things as if they were alive (e.g. 'eating' some food). Children with autistic spectrum disorders rarely show pretend play, but will show other types of play (e.g. functional play: using objects in accordance with their intended function) as much as their non-autistic peers (Ungerer & Sigman, 1981).

Without outside influence, autistic children are likely to become absorbed in repetitive, stereotyped activities (Sigman & Capps, 1997). However, when adults actively engage autistic three- or four-year-olds in two-way interactions (e.g. rolling a ball back and forth), the autistic children are just as engaged and seek to continue the game as much as non-autistic children of the same age (Mundy & Sigman, 1989). Autistic children would not *initiate* this contact without the structure of adult prompting (Sigman & Capps, 1997), but they do participate in certain types of play. Turn-taking during a simple game is difficult for the majority of autistic children, although children with high-functioning autism are as able as children without autism at doing so (Lord, 1993).

Pretend play is considered to be an early indicator of the development of theory of mind skills (Leslie, 1987), and is related to the presence of joint attention behaviours (Mundy et al, 1990).

Autistic Behaviour Before the Second Year

Retrospective studies have tried to determine if there are any early diagnostic indicators of autism before the second year by examining home videos (Osterling & Dawson, 1994) or infant health records (Johnson, Siddon, Frith and Morton, 1992), but have found few significant observable impairments before age 18 months. The Checklist for Autism in Toddlers (CHAT) was developed to be used by GPs or Health Visitors to facilitate early detection of autism at 18-month screenings (Baron-Cohen, Allen & Gillberg, 1992). It focuses on elements of social behaviour that have been shown empirically to be impaired in autism, including pretend play and protodeclarative gesturing. Baron-Cohen et al (1992) found that four children in a

group at high risk for developing autism (their siblings having already been diagnosed with autism) when screened at 18 months failed to show pretend play and joint attention behaviours. In comparison, none of the other children in the study (high-risk or randomly selected) failed to demonstrate more than one key behaviour. When followed-up at 30 months, only those four children who lacked joint attention and pretend play at 18 months had received a diagnosis of autism. This demonstrates that autistic children show impairments in social behaviour before two years of age (when autism is usually diagnosed) and suggests that impairments in pretend play and joint attention may be useful as early indicators of autism (Baron-Cohen et al, 1992).

The findings already discussed that autistic children show secure attachment to caregivers in pre-school years conflict with the above. It would be interesting to examine the attachment patterns at eighteen months of the children identified by the CHAT. Joint attention and play deficits may delay attachment until three or four years (the ages examined by Capps et al, 1994, and Rogers et al, 1991), or they may not have any impact on the development of a secure attachment to a caregiver. These apparently conflicting findings emphasise that deficits in social behaviour in autism are not across the board. Whatever the underlying cause, autism leaves some behaviours intact while severely impairing others.

Emotion Recognition

Children with autistic spectrum disorders are impaired in both their expression of emotions and understanding of other people's emotions. Children with autism

appear to be as accurate as children with similar verbal ability at naming simple emotions (e.g. happiness, sadness) in facial expressions (Ozonoff, Pennington & Rogers, 1990). However, they take significantly more time to do so (Capps, Yirmiya & Sigman, 1992), and are less able to match different elements of emotions (voice, facial expression, body movements and context) than non-autistic individuals (Hobson, 1986). These laboratory findings would have significant impact in everyday social interactions, where changes to these various different aspects of emotion would need to be quickly monitored, integrated and responded to from moment to moment.

Autistic children also show little empathy. Children without autism and children with learning disabilities respond to parents' (feigned) cries of pain or expressions of illness by looking concerned or offering comfort. In comparison, children with autism failed to make any eye contact or offer any comfort for their parent's simulated distress (Sigman et al, 1992). Autistic children may fail this task in part because of a lack of understanding of conventional social expressions of sympathy (Sigman & Capps, 1997).

Social referencing appears to play a part in later recognition, and even expression, of some more complicated emotions such as embarrassment and pride. Complex emotions such as guilt and embarrassment require reference to other people's thoughts and feelings (e.g. I'm only embarrassed about my untidy house when I think someone else thinks it is dirty). It appears that autistic children's impairment in the expression of emotions is limited to these emotions with a referential element. They

do show appropriate facial expressions and tone of voice for emotions such as fear, anger, happiness, sadness and surprise (Capps, Kasari, Yirmiya & Sigman, 1993), although less often than children with learning disabilities or normal children.

Anger Control and Apologising

Aggressive and destructive behaviour were common features of Asperger's original case descriptions (Asperger, 1944; reprinted and translated in Frith, 1991). Adults and children with autistic spectrum disorders may experience more stress and frustration, and therefore express more anger, than non-autistic people due to the very different ways they react to and interact with the world and other people around them. Problems with impulse control in high-functioning autistic individuals appear related to idiosyncratic problem solving styles and inflexibility (Attwood, 1998).

People with autistic spectrum disorders may be less able (or willing) to control their angry reactions if they lack an understanding of how their anger affects other people (Attwood, 1998). They also appear less aware of the social requirement to apologise or make reparations for angry outbursts (Tantam, 1991). Such social conventions must be learned. There may be a lack of motivation for such learning in autistic individuals if understanding of the importance of the mental states of others is impaired.

Conversation Skills

By the age of two or three years, children are able to take turns in conversation with adults and other children. Conversational skills such as joining an existing

conversation (without interrupting rudely), elaborating on topics or introducing new, mutually interesting topics, continue to develop throughout middle childhood (Sigman & Capps, 1997). Effective communication involves assessing what the listener knows and feels about certain topics and adjusting the language accordingly. Children as young as 2½ years show evidence of being able to make the appropriate adjustments in conversation (Tomasello & Mannle, 1985).

In contrast, a large proportion of children with autistic-spectrum disorders have severely impaired functional language. Autistic children and adults have particular difficulty initiating and maintaining both topic and flow of conversation (Frith, 1989a). Even when autistic children have good language abilities, they rarely make comments that add new and relevant information to an ongoing conversation, unlike children with Down's syndrome or normal children (Tager-Flusberg, 1993).

Turn-taking in group conversations is laboured as autistic people generally fail to use eye contact to regulate flow of speech, and so they interrupt and introduce irrelevant topics of conversation, often about their own particular interest (Bruner & Feldman, 1993). However, children with high-functioning autism or Asperger's syndrome are able to take turns appropriately when the number of people in the conversation is limited to just two (Bruner & Feldman, 1993). Children with autistic spectrum disorders also appear unable to judge a listener's interest in their conversation and can maintain long monologues on their favourite subject (Baron-Cohen & Howlin, 1993).

Everyday conversations frequently include many words and phrases that are not meant to be taken literally. The meaning of many figurative modes of speech (sarcasm, idiom, etc.) depends upon the listener understanding that the intent behind the communication was that the statement should not be taken literally. Successful interactions depend upon those involved monitoring and judging that the communication is being understood as it was intended, and modifying the communication when and if required (Baron-Cohen, 1994). Many individuals with autism are handicapped by a literal understanding of speech and therefore frequently fail to understand others' communicative intent and fail to adjust their own language to ensure comprehension by their audience (Sigman & Capps, 1997).

Conversation with autistic individuals is often only maintained by the frequent asking of questions (Hurtig, Ensrud & Tomblin, 1982), a conversational habit that many autistic children seem to adopt and carry on into adulthood (Sigman & Capps, 1997). Autistic children do not appear to develop the understanding that conversations involve the (two-way) exchange of information (Tager-Flusberg, 1993). Children and adults with autistic spectrum disorders also frequently break the social rules of conversation by asking questions or making comments that are embarrassing or overly personal (Frith, 1989; Tantam, 1991).

Friendship

As children reach school age, relationships with family members are still important, but friendships with peers increasingly become important too. From about age seven, children develop stable groups of friends, which in middle childhood are

defined by gender values and norms (Hartup, 1992). Conformity to these values and norms, which are often implicit, is required to remain part of the social group (Sigman & Capps, 1997). It is unsurprising that children with autistic spectrum disorders often fail to be part of a group, and that what friendships they have are often maintained by their parents (Sigman & Capps, 1997). The majority of high-functioning autistic children, when asked, can identify one or two friends, but do not have a 'best friend'. In comparison, non-autistic children could name one or two 'best friends', as well as a much larger group of friends (Sigman & Capps, 1997).

Adolescents with high-functioning autism or Asperger's syndrome may develop proscribed friendships, perhaps based on restricted interests, but in the main their relationships are family based (Attwood, 1998; Sigman & Capps, 1997), in contrast with the drive for independence from the family seen in non-autistic adolescents.

Summary

Autistic children fail to perform a wide range of interpersonal social skills. Many of these skills can be linked to the ability to understand the mental lives of people, their emotions, thoughts and intentions. Poor conversation skills may be related to an inability to perceive the intention of the speaker, or to an inability to perceive the effect of one's communication on the listener. The ability to avoid conflict with others, by controlling angry or hurt reactions, could be adversely affected by a lack of understanding of how anger adversely affects other people. The ability to perceive or display complex emotions such as embarrassment may be impaired by an inability to reflect on other people's negative perceptions.

A wide range of social behaviours thus appear to be linked to an awareness of mental states. There is a wide variability of social skills and deficits in autism and some social skills do develop (in some cases as a result of social skills training). Also, a social behaviour may be available in a child's repertoire but not performed for one reason or another (e.g. lack of opportunity, lack of motivation, lack of reward, lack of knowledge of when to use the social skill). These factors make the task of finding a single causal factor underlying the specific pattern of social presentation in autism difficult. The Theory of Mind deficit account of autism is an important attempt to explain the pattern of preserved and impaired social behaviour specific to that disorder. This theory is reviewed next.

1.4 Theory of Mind Deficits in Autism

The impairments in social behaviour seen in children and adults with autism are not uniform across the whole autistic spectrum. Nor are all social behaviours impaired; some abilities are preserved, especially in high-functioning autistic individuals. One explanation of the mix of core impairments and preserved abilities in autism was suggested by Baron-Cohen, Leslie and Frith (1985). They suggested that social impairments, other core impairments and islets of ability, could be explained by a single deficit – an inability to attribute mental states to oneself and others. The term “theory of mind” is used to refer to this ability to represent mental states.

What is Theory of Mind?

Perhaps the most clear and concise definition of theory of mind is that of Baron-Cohen, Tager-Flusberg and Cohen (1993):

[Theory of mind is] the ability of normal children to attribute mental states (such as beliefs, desires and intentions, etc.) to themselves and other people, as a way of making sense of and predicting behaviour (p.3).

Theory of mind is the ability to think about thoughts (“mentalise”). This ability to make judgements about what other people believe to be the case in any given situation allows an individual to predict what they will do. For example, I know Jane believes her coat is in the wardrobe and I can predict she will look for it there, even though her coat is really in the hall.

Theory of mind ability can involve different levels of attributions. The most basic level (zero order) involves beliefs or concepts about the physical state of the world (“I know the coat is in the hall”). The next level of theory of mind ability (1st order) involves judgements about another person’s mental state about the world (“I think that Jane thinks her coat is in the wardrobe”). Second order theory of mind involves more complex attributions, involving the individual making a judgement about another person’s mental state with regard to yet another’s mental state about the world (“I think that Peter thinks that Jane believes her coat is in the hall”). Thus, theory of mind ability includes the concept that people have minds and mental states that are independent of other people’s minds and mental states, and these mental states (and not necessarily the real state of the world) influence their behaviour.

Table 1.1. Examples of mental state terms.

Mental State Terms	Pretend, Imagine, Believe, Know, Want, Attend, Perceive, Doubt, Suspect, Hope, Deceive, Intend, Happy, Thoughtful, Idea, Forget
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Background

Premack & Woodruff (1978) carried out the original studies on theory of mind, examining a chimpanzee’s awareness of mental states in others. They argued that the chimpanzee’s ability to predict and interpret a human’s behaviour in terms of mental states (using a symbol system) indicated that it had a theory of mind. Later discussion about this study pointed out that the critical test of the ability to represent mental states is the ability to recognise someone’s false belief. Wimmer & Perner (1983) therefore devised a false belief task to test 1st order theory of mind ability in young normal children. The “Sally-Anne” test was designed to be a stringent test of the ability to represent mental states. In such false belief tasks, it is possible to

distinguish clearly between the child's judgements about their own (true) belief, from those based on their knowledge of another person's different (false) belief. Consequently, if the child knows the marble is in the red box, but that Sally thinks it's in the blue box, when asked where Sally will look for the marble, the child should judge that she will look in the wrong place – the blue box. Wimmer & Perner (1983) found using this task that evidence of theory of mind ability did not reliably appear until about four years of age in normal development. Using another false belief story, they found that 2nd order ability did not develop until between five and seven years of age (Perner & Wimmer, 1985).

Theory of Mind Deficit in Autism.

Baron-Cohen, Leslie and Frith (1985) adapted Wimmer & Perner's (1983) task to examine theory of mind ability in children with autism, putting forward the hypothesis that a deficit in theory of mind ability was the underlying cause of autistic children's social and communicative impairments. They found that 80% of their autistic participants, compared to 14% of children with Down's Syndrome, failed the experimental false belief task, which the researchers claimed demonstrated a problem with understanding mental states specific to autism. This basic finding of impairment at the 1st order level has been replicated using the same paradigm (e.g. Reed & Peterson, 1990), similar paradigms (e.g. Sparrevohn & Howie, 1995) and different but comparable methods (Dawson & Fernald, 1987), and all have found some proportion of the autistic participants fail theory of mind tasks (see Table 1.2).

Table 1.2. Mean chronological age (CA) and verbal mental age (VMA) and percentages of autistic participants who passed 1st or 2nd order theory of mind tasks in several different studies of theory of mind ability.

Study	Mean C.A.	Mean V.M.A.	Passed 1 st Order	Passed 2 nd Order
Prior et al (1990)	9.92	7.16	50%	-
Sparrevohn & Howie (1995)	10.17	7.75	53%	30%
Baron-Cohen et al (1985)	11.92	5.42	20%	-
Reed & Peterson (1990)	12.00	7.08	15%	-
Baron-Cohen (1989)	15.33	7.83	-	0%
Tager-Flusberg & Sullivan (1994a)	16.92	-	90%	-
Tager-Flusberg & Sullivan (1994b)	17.08	9.67	-	58%
Bowler (1992)	26.67	-	93%	73%

The now classic Sally-Anne paradigm examines the ability to make a judgement about another person's mental state in relation to the physical world – 1st order theory of mind ability (“I think that John thinks that...”). The next level of theory of mind requires the individual to make a judgement about another person's mental state with regard to yet another's mental state about the world (“I think that John thinks that Mary thinks...”).

One method that has been used to examine this 2nd order theory of mind ability is the Ice Cream Van Story. This 2nd order false belief story (described in full in Sections 2.3 and 2.4) relates a series of events about a child, John, who wants to buy an ice cream. After the ice cream man changes his mind about where he will sell his ice cream, another character in the story, Mary, comes to hold a false belief about where John has gone to buy the ice cream. Again, the listener's true belief about the whereabouts of John can be distinguished clearly from the false belief of the story character, Mary.

Baron-Cohen (1989) examined 2nd order theory of mind ability with the Ice Cream Van Story in a group of autistic children who were able to pass a 1st order theory of

mind task (the Sally-Anne task). This group of autistic children, in comparison to learning disabled and normal controls, was impaired in their ability to make 2nd order belief attributions. All the control participants in this study were able to justify their answers to the false belief question in this study with 2nd order explanations, unlike the autistic participants who were more likely to use (incorrect) 1st order justifications or physical justifications. Baron-Cohen (1989) concluded that, although some children with autism were able to develop the first level of theory of mind ability, they were specifically delayed in their development of 2nd order theory of mind, and a high verbal ability was “a necessary but not sufficient condition” for the acquisition of any level of theory of mind.

Holroyd & Baron-Cohen (1993) followed up the same group of autistic children from the Baron-Cohen et al (1985) study seven years later to find out how much, if any, development in theory of mind ability there had been. Only one child who had previously failed the Sally-Anne task passed in this follow-up study, although two who had previously passed now failed, despite a general increase in verbal mental age. Overall, there was no change in theory of mind ability over the seven years gap between studies. Holroyd & Baron-Cohen (1993) concluded there was a limit on development of theory of mind in autistic children at about the 1st order level, although the test-retest reliability of the Sally-Anne task could have been a factor influencing the results. This conclusion conflicts with the results of those studies that have found some autistic children able to pass 2nd order theory of mind tasks (e.g. Bowler, 1992).

Bowler (1992) aimed to replicate and extend the findings of Baron-Cohen and colleagues (Baron-Cohen et al, 1985; Baron-Cohen, 1989) with young adults with Asperger's syndrome. However, he found very different results: that 93% of these participants passed the 1st order task, and 73% passed the 2nd order task, performances not significantly different from the control groups of students and people with schizophrenia.

Also in contrast to Baron-Cohen's (1989) results, the autistic and control participants in Bowler's (1992) study all *failed* to give 2nd order justifications for their (mainly correct) answers to the 2nd order belief question. Bowler (1992) examined the reasons given for the answers to false belief questions and found that most of his participants' justifications focussed on the point of the story where the false belief is explicitly set up (when the ice cream man changes his mind about where he will sell his ice creams).

Bowler (1992) was able to increase all participants' use of mental state justifications in a revised 2nd order false belief story, by changing the event leading to the false belief in the story to a random rather than explicit act. This supported Bowler's argument that the nature and wording of the story influences the types of explanations used. However, as mental state justifications were still rare in all the participant groups in this study, Bowler (1992) suggested that social impairment was not predicted by failure to use mental state terms in justifications.

Other researchers have also found evidence of theory of mind task success in individuals with autistic spectrum disorders. Sparrevohn & Howie (1995) found 53% of children with high-functioning autism in their study passed a 1st order task and 30% passed the 2nd order Ice Cream Van task. Tager-Flusberg & Sullivan (1994a) found a greater proportion (90%) of autistic children and adults passed 1st order false belief tasks and in a different study by the same authors, 58% of children and young adults with autistic spectrum disorders passed a 2nd order false belief task (Tager-Flusberg & Sullivan, 1994b).

Tager-Flusberg & Sullivan (1994a) suggested that the relatively good performance of their autistic participants on 1st order false belief tasks, in comparison with Baron-Cohen et al (1985), was strongly influenced by verbal ability, particularly knowledge of complex sentence structure. Tager-Flusberg & Sullivan (1994b) concluded that children who passed 1st order false belief tasks had difficulty with 2nd order tasks because of the increased information processing demands of 2nd order tasks, rather than difficulties in reasoning about beliefs about beliefs *per se*.

Sparrevohn & Howie (1995) explained the differences in task success between their study and studies by Baron-Cohen and colleagues (Baron-Cohen et al, 1985; Baron-Cohen, 1989; Holroyd & Baron-Cohen, 1993) with reference to confounding factors such as verbal and non-verbal ability, or the possibility that high-functioning autistic individuals may succeed on false belief tasks using abilities other than theory of mind. These possibilities are discussed in more detail in later sections in this Introduction.

1.5 Perceptual vs. Conceptual Perspective Taking.

Baron-Cohen et al's (1985) theory of mind hypothesis of autism predicts that autistic individuals' inability to ascertain another's point of view is limited to *cognitive* perspective taking. Although *perceptual* perspective taking (ascertaining what is in another's field of vision) also involves awareness of another's point of view, only cognitive perspective-taking requires inferences about the mental states of others. Therefore, individuals with autism should be as able as non-autistic people at tasks such as, for example, Piaget's three mountains task (Piaget & Inhelder, 1956). This task involves asking a child to say how a doll, placed in various positions, would view a three-dimensional display of three distinguishable mountains from different viewpoints.

Reed & Peterson's (1990) carefully controlled study comparing cognitive and visual perspective taking in children with autism showed that, as predicted, they are not impaired in visual perspective-taking tasks. Children with autism are no different from children with learning disabilities or normal children in their ability to correctly judge what another person can see from a different position. However, the children were impaired on the cognitive perspective taking tasks despite relatively high verbal and chronological ages. The second level of cognitive perspective taking in this study had the same false belief question as classic 1st order task ("Where will Sally look for her marble?") but higher processing demands with more characters and places to hide the marble. This could account for the small number of the able autistic participants who passed this cognitive perspective taking task (15%) and the difference in performance between tasks, as the perceptual perspective-taking tasks

in this study were much less demanding of information processing. However, Leslie & Frith (1988) also found preserved visual perspective taking in autistic children along with impaired cognitive perspective taking, using easier cognitive tasks.

Dawson & Fernald (1987) assessed the relationship between social behaviour and three types of perspective taking ability (perceptual, conceptual and affective) in autistic children. Of the three types, conceptual perspective-taking ability was found to be the most strongly related to social behaviour as measured by the Vineland Adaptive Behavior Scales, although the combined score of perspective-taking ability was also significantly related to all of their social behaviour measures.

One criticism of these findings of preserved visual perspective taking is that the visual tasks in these studies could only require the child to make the most basic level (zero order) representation of the physical state of the world but the cognitive perspective taking tasks required the next level of representation (1st order) of the world. Thus, differences could be due to the different reasoning demands the two types of task required, rather than a specific impairment in the attribution of mental states.

There are some non-mental 1st order representations that are in everyday use: pictures, photographs and maps. Such non-mental representations have been shown to be understood by autistic children in tasks comparable to the Sally-Anne task (Leekam & Perner, 1991; Leslie & Thaiss, 1992). Thus, it appears that autistic

individuals' inability to ascertain another's point of view *is* limited to cognitive perspective taking.

1.6 Development of Theory of Mind

Although much research has centred on the performance of autistic individuals on *belief* tasks, there is some evidence that the development of understanding of other mental states (e.g. desire, pretence, imagination, etc.) may also be delayed or abnormal in autism.

Non-autistic children refer to such mental states as perception, desire, belief and emotion during the earliest stages of language development (Baron-Cohen, 1994). In the pre-school years, children develop an understanding that perception is pivotal to the acquisition of knowledge (Jane will know her coat is in the hall only if she saw or heard about its whereabouts) and plays a part in the acquisition of beliefs. They also develop an understanding that beliefs and desires together cause action (“Jane *wants* her coat and *thinks* it is in the wardrobe, so she *goes* to look for it there”), and emotions are caused in part by underlying desires and beliefs (“Jane is *surprised* when she looks in the wardrobe because she *wants* her coat and she *thought* it was there”).

Young children's understanding of mental states appears to follow a three-stage model of development. Understanding of perception, pretence and imagination develops before understanding of desire and intention, which in turn are understood before knowledge and belief (Gopnik & Slaughter, 1991). Similarly, understanding

that desires relate to emotions appears to come before understanding of how beliefs can cause emotion (Wellman & Banerjee, 1991).

Baron-Cohen (1991) examined whether children with autism would also follow Gopnik & Slaughter's (1991) three-stage model of development of understanding of mental states. In contrast to normal children and children with learning disabilities, children with autism found imagination and pretence even more difficult to understand than desire, although belief was still the most difficult mental state to understand. Thus, children with autism appear to progress through a different sequence of mental state acquisition, as well as being delayed in comparison to non-autistic children, and even in comparison to children of the same mental age (Baron-Cohen, 1991). Theory of mind deficits in autistic individuals, therefore, are not limited to their understanding of belief. Even though autistic children may develop an understanding of some mental states, the effect of a delay in this acquisition would be disastrous for the development of normal reciprocal social interaction.

Sparrevohn & Howie (1995) looked for evidence of a developmental progression of the understanding of belief by breaking down the elements of classic (1st order) false belief tasks into components of (hypothesised) increasing difficulty. They found 90% of their young autistic participants showed a sequence of decreasing success on increasingly more difficult belief tasks, from the easiest Inferred Belief task (e.g. "This morning Jane saw her coloured pencils on the desk, not on the shelf. Now Jane wants her coloured pencils. Where will she look for them?") up to 2nd order false belief (the Ice Cream Van story). The researchers found that making the false

belief explicit by telling the child that the character holds a belief that is false, increased success on this task in comparison to the more classic 1st order “Smarties” task, where the false belief is inferred (67% and 53% respectively). As there was no non-autistic control group in this study, it cannot be said whether the developmental sequence in understanding belief found in this study is the same, delayed or deviant from normal development.

1.7 The Role of Age and Verbal Ability

The majority of autistic individuals function within the range of learning disabilities and social deficits must be viewed within that context (Volkmar & Klin, 1993). However, at the high-functioning end of the autistic spectrum, there are some individuals with verbal and other cognitive abilities within the average range. The influences of verbal ability and chronological age are briefly reviewed here.

In Baron-Cohen et al’s (1985) study, the 20% of autistic participants who passed the false belief task had verbal mental ages ranging from two years nine months to seven years. This was similar to the verbal mental ages of the autistic participants who failed the task. The Down’s syndrome controls (the majority of whom passed the task) had lower verbal mental ages than the autistic participants and the “normal” controls (who also passed the task) had chronological ages lower than the autistic participants. Baron-Cohen et al (1985) therefore concluded that the theory of mind deficit seen in participants was independent of chronological age, poor verbal ability and general learning disabilities.

In a further study, Baron-Cohen (1991) found that mean chronological and verbal mental ages did not differ between autistic children who passed or failed a false belief task, but that both were factors influencing task success.

Some researchers who have subsequently found, in comparison with Baron-Cohen et al's (1985) study, different proportions of autistic individuals successful at theory of mind tasks have tried to explain the variations in terms of chronological or verbal mental age differences and the developmental course of theory of mind ability. See Table 1.2 (pg. 21) for comparisons of chronological and verbal mental ages and proportions of autistic participants who pass theory of mind tasks across several different studies.

Prior, Dahlstrom & Squires (1990) suggested that verbal ability may be central to the development or demonstration of theory of mind ability in autistic children. They found a relationship between verbal mental age and theory of mind task performance and suggested that a verbal mental age of at least six years was required for success on false belief tasks for children with autism, although this was not sufficient to ensure success. This was confounded with the finding that chronological age was also related to success on theory of mind tasks, as no child under the age of eight years passed all the tasks.

Leekam & Perner (1991) found that verbal mental age, but not chronological age or non-verbal mental age, distinguished autistic individuals who passed and failed theory of mind tasks. Bowler (1992) also found that only measures of verbal ability

were associated with the ability to justify 2nd order false belief responses in people with Asperger's syndrome. Leslie & Roth (1993) reviewed the evidence and suggested that the children with high-functioning autism who pass theory of mind tasks generally have a verbal mental age of over five years six months *and* a chronological age of eleven years or over, but that about half of autistic individuals who meet these criteria still fail theory of mind tasks.

One of the main aims of Sparrevohn & Howie's (1995) study was to examine the influence of verbal ability on success on theory of mind tasks when confounding factors such as chronological age and non-verbal ability were controlled for. They matched participants on non-verbal mental age and mean chronological age and found that theory of mind success differed between groups separated on the basis of high and low verbal ability. Success on the 2nd order task was also more likely for the high verbal ability group, who all had verbal mental ages of seven years or above and a mean chronological age of eleven years four months.

Baron-Cohen and colleagues (Baron-Cohen et al, 1985; Baron-Cohen, 1991) used the British Picture Vocabulary Scale (BPVS; Dunn, Dunn, Whetton & Pintilie, 1982) to estimate the level of verbal functioning of participants. This is a measure of receptive vocabulary only. Later empirical findings of the importance of verbal ability as a factor in theory of mind task success has made it desirable to include other measures of language ability (e.g. expressive ability) but few researchers have done so, mainly to aid comparison with Baron-Cohen's initial studies.

Fombonne, Siddons, Achard, Frith & Happé (1994) found that Verbal IQ was a significant factor influencing performance of social skills in everyday life that required mentalising ability and also performance on 1st order theory of mind tasks. Higher verbal ability was associated with success on theory of mind tasks, although only for the autistic participants. The verbal ability of normal and learning disabled children did not significantly influence theory of mind task performance. Higher verbal ability was also associated with more adaptive behaviour in everyday life (Fombonne et al, 1994).

1.8 Theory of Mind and Social Skills.

There is evidence that social skills in autistic individuals are abnormal for both their chronological age and mental age level (Loveland and Kelly, 1988). Volkmar, Bregman, Cohen, Hooks & Stevenson (1989) used predictive equations based on the Vineland Adaptive Behavior Scales standardisation data and found that deficits in social skills in autism were only partially explained by mental age alone; another factor was influencing the severe social impairments in autism. Baron-Cohen and colleagues (e.g. Baron-Cohen et al, 1985) would hypothesise that the other influencing factor was theory of mind ability.

The theory of mind deficit account of autism makes specific predictions about which social skills will be impaired in autistic individuals. A deficit in the ability to think about thoughts should reveal itself in everyday life as social impairment, although only those social skills that require the ability to understand and represent mental states will be impaired (Baron-Cohen, 1988). Social skills that can be learned or

successfully performed without theory of mind ability will not be influenced by theory of mind deficits. Thus, responding to hints and indirect cues in conversation requires the ability to understand another's mental state and should be impaired in autistic individuals, whereas taking turns while playing games could be achieved through rote learning of a simple rule or social learning. Although having theory of mind ability presumably may make this task easier, a deficit in theory of mind ability should not prevent autistic individuals showing this social behaviour. Baron-Cohen, Leslie and Frith (1985) suggested that the small number of autistic children who pass theory of mind tests would show a different pattern of social impairments than the majority who fail such tests.

The pattern of social skills and deficits as predicted by Baron-Cohen et al (1985) has been found in normal pre-school children. Lalonde and Chandler (1995) looked for correlations between theory of mind performance and everyday social skills in normal three-year-olds. They found that social skills governed by simple rules or social convention (e.g. responding appropriately when introduced to a stranger) did not correlate with a child's attainment of 1st order theory of mind. However, social skills which were not easily governed by a simple set of rules, but which require a measure of insight into others' mental states (e.g. playing with a group of peers in co-operative activity without supervision) did positively correlate with a child's theory of mind ability. Those children who had already developed theory of mind ability at age three were more likely to show social skills requiring such insight than those children who did not pass theory of mind tasks.

However, only eight out of a possible forty items in Lalonde & Chandler's (1995) study correlated positively and significantly with theory of mind ability in this group of young normal children. This complements the findings of Frith, Happé and Siddons (1994), who found that theory of mind was not a good predictor of everyday social adaptation in normal and learning disabled children. Normal three-year-olds who fail false belief tasks do not entirely lack the ability to understand mental states: they can understand true beliefs (Wellman & Bartsch, 1988), can use mental state terms correctly (Baron-Cohen, 1994) and can pass non-standard theory of mind tasks (Wellman, 1993). Such abilities, precursors to the ability to understand false belief, will facilitate social functioning in normal children. Relationships between theory of mind and social skills in normal children will be confounded by the apparently continuous developmental progress in elements of theory of mind ability.

Frith, Happé and Siddons (1994) examined the pattern of social skills and deficits in autism using a different, "top-down" methodology, by identifying and expanding on items of the Vineland Adaptive Behavior Scales that appear to rely upon theory of mind ability. These items were identified from theoretical hypotheses and the ratings of undergraduate students. In the same way, these items were distinguished from examples of social behaviour that seemed possible without the understanding of mental states. Frith et al (1994) explored the relationship between these two groups of everyday social behaviours and performance on 1st order theory of mind tests. They found that only those autistic children who passed theory of mind tasks showed social behaviour that necessitated theory of mind, in contrast to the learning disabled and normal controls. Autistic children who failed the theory of mind tasks showed

little evidence of understanding mental states in their everyday lives. In comparison, young normal and learning disabled children did not differ on any variable in relation to theory of mind performance – even those who failed theory of mind tasks still showed evidence of theory of mind ability in everyday life. This suggests that theory of mind ability alone is insufficient to pass theory of mind tasks, or that theory of mind tasks are not reliable tests of theory of mind ability.

There was remarkable dissimilarity between the items of behaviour Frith et al (1994) and Lalonde and Chandler (1995) judged to be associated with theory of mind ability. Of the sixteen items Frith et al (1994) rated as being strongly associated with theory of mind ability, only one of those items was correlated with success on theory of mind tasks in the young normal children in Lalonde and Chandler's (1995) study. Although drawn from the same large initial pool of items (the Vineland Adaptive Behavior Scales), there was little overlap between the two studies' sets of behaviours that were hypothesised to require theory of mind ability.

Unremarkably, the sets of behaviours not requiring theory of mind ability, which were a large proportion of the total set of Vineland items, were fairly similar (38% concordance). However, two items directly contradicted each other. Playing board games was significantly correlated with success on theory of mind tasks in Lalonde & Chandler's (1995) study, whereas Frith et al's (1994) raters judged that playing simple board games did not necessitate theory of mind ability. More significantly, Frith et al (1994) judged that "apologising for hurting another's feelings" required

theory of mind, yet no correlation was found between these in Lalonde & Chandler's (1995) young normal sample.

Frith et al (1994) did not report which and how many individual items were significantly and positively correlated with theory of mind performance and so direct comparisons between these two studies cannot be made. However, the differences in the items included in the mentalist sets of social behaviour are indicative of the difficulty in judging which social skills unequivocally require theory of mind ability.

Frith et al (1994) also identified two groups of autistic participants who passed theory of mind tasks but differed in the amount of everyday mentalist social behaviours they performed. One group more frequently showed those social behaviours that seemed to require theory of mind ability, whereas the other group were no different from those who failed theory of mind tasks in demonstrating evidence of mentalising abilities in everyday social skills. Frith et al (1994) concluded that there is evidence of both theory of mind ability and logical, non-theory of mind strategies in use in the autistic population aiding performance in social situations. This has been replicated in cross-cultural studies with French children, adolescents and young adults with autistic-spectrum disorders (Fombonne, Siddons, Achard, Frith & Happé, 1994; Hughes, Soares-Boucaud, Hochmann & Frith, 1997).

The autistic children who passed theory of mind tasks in Frith and colleagues studies (Frith et al, 1994; Fombonne et al, 1994; Hughes et al, 1997) were socially impaired

in comparison to the non-autistic population despite their ability to solve such tasks. This indicates that having a theory of mind, for children with autism at least, does not protect against social impairment. It is possible that these children possess mentalising skills but fail to apply this knowledge when appropriate, and thus remain socially impaired (Bowler, 1992).

Alternatively, theory of mind task success could be due to mechanisms other than mentalising ability, such as logical reasoning skills, which are used to by-pass the lack of theory of mind. Such strategies are likely to be less flexible and slower than using the more appropriate theory of mind ability. A child with autism who used general strategies, less specific than theory of mind, to solve 1st or 2nd order tasks would remain socially impaired as such strategies would be cumbersome to use in everyday social situations (Bowler, 1992).

These two possibilities, that (i) theory of mind task success could be due to mechanisms other than mentalising ability and that (ii) it is a failure in performance rather than ability that characterises the relationship between theory of mind task success and social deficits in autism, are discussed in the following sections.

1.9 Strategies for Passing Theory of Mind Tasks

A significant number of individuals with autistic-spectrum disorders are able to pass theory of mind tasks. Baron-Cohen et al (1985) suggested that, if a deficit in theory of mind is behind failure in social situations, the small number of autistic children who pass theory of mind tests would show a different pattern of social impairments

than the majority who fail such tests. There does seem to be some evidence that children who pass theory of mind tasks are more likely to show social skills that require mentalising ability (Fombonne et al, 1994; Frith et al, 1994; Hughes et al, 1997).

However, success on theory of mind tasks, rather than indicating the use of theory of mind ability, could also be due to autistic individuals using logical mechanisms to circumvent their lack of intuitive knowledge of social behaviour. The data from Frith et al (1994) and Bowler (1992), where theory of mind task success co-existed with severe social impairment, are consistent with this suggestion.

Bowler (1992) suggested that the form and wording of classic theory of mind tasks may influence task success. For example, features of the Ice Cream Van story appear to direct individuals to use non-mentalist strategies to solve the task. The majority of Bowler's (1992) participants, autistic and non-autistic controls alike, gave justifications for their responses that referred to the point in the story when the false belief is established (when the ice cream man explicitly changes his mind about where he will sell his ice cream). This pivotal point in the story is explicitly stated in the narration and this appears to cue individuals trying to solve the task to use justifications that refer to this point. Thus, non-mentalist strategies are just as appropriate as mentalist when solving this task and are actually encouraged by the form of the story.

This could explain why Bowler's (1992) autistic participants were not impaired on this task in comparison to non-autistic controls: the controls, who presumably would use mentalist strategies in everyday life when dealing with other people's beliefs, were cued in to using the non-mentalist strategies that autistic people would normally use. As both mentalist and non-mentalist strategies can be used to solve the Ice Cream Van task, the autistic participants were not differentially impaired on this task. However, the non-mentalist strategies are a disadvantage in everyday life when dealing with the mental lives of other people and thus the autistic individuals who passed this task remained socially impaired in everyday life.

In part to address the issue of whether the form of the task can influence the results, Happé (1994) developed a set of vignettes designed to be more naturalistic tests of theory of mind abilities than the classic theory of mind tasks. The "Strange Stories" describe everyday situations where characters say things that are not meant literally. The aim of the "Strange Stories" task is to describe the characters' intentions or motivations and in this way are related to theory of mind.

Happé (1994) compared eighteen autistic adults' and children's performance on standard theory of mind tests with performance on the set of "Strange Stories". In addition to a comprehension test question, the Strange Stories also ask the participant to provide a justification for their answer, thus allowing closer inspection of the strategies used by autistic individuals to solve theory of mind tasks. Happé (1994) found that performance on the Strange Stories was closely related to performance on standard theory of mind tests, but that the Strange Stories enhanced the detection of

impairments in mentalising ability as the ability to provide mental state explanations for people's behaviour could be examined. The autistic participants did not differ from the learning disabled and normal control groups in the use of mental states in their answers, but their responses were less appropriate and less accurate in the context.

Happé (1994) found evidence in the Justification responses of individuals with autism who seemed to be using non-mentalist strategies to answer the problem of characters' intentions. Several autistic participants tended to use just one or two mental state justifications repeatedly, possibly indicating that they had rote learned one or two explanations for situations when people say things they do not understand and applied them without any real understanding of the mental state terms.

In his study looking at teaching false belief to children with autism, Swettenham (1996) also found evidence consistent with the idea that the autistic children can learn to use non-mentalist strategies to solve the false belief tasks. Following instruction, the children could pass false belief tasks similar in format to the ones used in the teaching, but could not generalise this success to false belief tasks different in format, although normal three-year-olds and children with Down's Syndrome could do so.

Leslie & Roth (1993) made the suggestion that success on theory of mind tasks for people with autism may be an indication of the use of strategies that have developed to compensate for a theory of mind dysfunction. These compensatory strategies may be based in other types of reasoning that remain intact in autism. Theory of mind,

when it works, is fast and spontaneous and (possibly) innate and develops before the higher order logical reasoning which would be required for a successful compensatory ability and hence the delay of evidence of mentalising ability in children with autism.

Leslie & Roth (1993) propose that one possible way for autistic children to compensate for a lack of theory of mind ability is to use a strategy based on the rules of language. Some language structures appear to be specifically 'designed' for conveying information about mental states (Tager-Flusberg, 1993). For example, mental state terms are often embedded in syntactic structures that Leslie & Roth (1993) suggest can be used as cues to the underlying mental concept encoded in the mental-state verb. Leslie & Roth (1993) acknowledge the complexity of this strategy as a compensation for a lack of intuitive understanding of mental states and the requirement for high level general reasoning abilities to be intact.

1.10 Central Coherence

Bowler (1992) suggested that the co-existence of social deficits and success on theory of mind tasks could be explained by autistic participants' failure to apply the knowledge they had of mental states in the relevant social situations. Frith (1989a) has proposed a hypothesis that could explain this failure to see the relevance of knowledge to particular problems: weak central coherence.

Frith (1989a) suggested that individuals with autism are uniquely unable to integrate information at different levels of meaning, and that this is the cognitive deficit

underlying autistic spectrum disorders. During normal information processing, an individual draws together disparate pieces of information to form a higher-level, contextually appropriate Gestalt. This process Frith (1989a) labelled the “drive for central coherence”. For example, a familiar person’s face can be brought to mind, described and recognised, but the exact colour of their eyes and the shape of their nose are a struggle or impossible to recall. Frith (1989a) suggested that a lack of central coherence could explain the pattern of abilities and deficits seen in autistic individuals. Free from the need to process information in context, individuals with autistic spectrum disorders would have the advantage when attention to detail (local information) was required, but would be disadvantaged when the processing of global meaning was necessary (Frith, 1989).

There are some experimental findings that appear to support the central coherence theory of autism. Autistic individuals show consistently superior performance on the Block Design subtest of the Wechsler Intelligence Scales relative to their mean non-verbal performance, and sometimes relative to their non-autistic peers (e.g. Ehlers, Nydén, Gillberg, Sandberg, Dahlgren, Hjelmqvist & Odén, 1997). The subtest requires the construction of a design using individual blocks, the strong Gestalt qualities of the original designs making it difficult to mentally separate the design into separate blocks for reconstruction. The central coherence theory predicts that individuals with autistic spectrum disorders would not benefit from pre-segmentation of the designs due to their specific ability to discern parts over wholes, whereas non-autistic people would benefit from such pre-segmentation. Shah & Frith (1993) found just this pattern of results when they presented autistic and non-autistic

children with block designs that had either intact or pre-segmented models. The autistic children only showed superior performance compared to controls when working from intact models.

Weeks & Hobson (1987) found that children with autism, when given a free choice, sorted photographs of faces by type of hat, whereas the non-autistic controls sorted by facial expression. Many of the autistic participants could sort by facial expression when asked, indicating that weak central coherence influences the preferred processing style (subconsciously), rather than blocking all ability to process globally.

If a weak central coherence is more appropriately perceived as a *preferred* processing style rather than a cognitive *impairment*, then weak central coherence may not be specific to autistic spectrum disorders. Jarrold & Russell (1997) examined this possibility using a task requiring autistic, learning disabled and normal children to count and remember the numbers of dots on a series of cards. The dots were presented in a random pattern or in patterns as on a die. Children with autism appeared to receive no benefit from the global pattern of dots in die form, performing equally well in both types of presentation, unlike the controls who counted random dot patterns more slowly. However, the failure to count globally was not specific to the autistic participants, as about one-third of the learning disabled controls also failed to do so. As all the participants in this study were matched for verbal ability but not non-verbal or visuo-spatial ability, it is difficult to discern whether this result is a reflection of a processing style that is associated with learning disabilities, visuo-spatial ability or autism.

The central coherence theory also predicts that autistic individuals would be specifically disadvantaged where task demands involve the processing of individual items in context (global meaning). Happé (1997) examined autistic children and adults on a test of homograph reading. Homographs are words that are spelled the same but pronounced differently depending on the context: I told her where I *live*; The band performed *live*. As the processing of the whole context is required to pronounce these words correctly, central coherence theory predicts that autistic individuals will be specifically impaired in this task. Happé (1997) found that the autistic participants of this study did not show evidence of using the global context to find the correct pronunciation of the individual homographs, unlike the non-autistic controls.

Happé (1997) also compared performance on the homograph task across different levels of theory of mind ability. The effect of weak central coherence was independent of theory of mind performance – even some of the participants who were successful on 1st order or 2nd order theory of mind tasks failed to use the context to produce the correct homograph pronunciation. Happé (1997) concluded “a deficit in central coherence can coexist with a degree of theory of mind task competence”. This means it is unlikely that a theory of mind deficit is a by-product of weak central coherence.

It is only relatively recently that Frith's (1989) weak central coherence theory has been tested empirically and there are therefore no validated or reliable tests of central coherence in the literature. No empirical testing of this theory has yet been carried

out with reference to social behaviour. It therefore remains unclear how central coherence relates to everyday social behaviour in children with autism.

1.11 Social Reasoning

Social reasoning can be defined as that part of cognition concerned with people, their actions and adaptive social functioning (Herbert, 1991) and can refer to understanding of different social rules which apply in different social situations (Beveridge & Conti-Ramsden, 1987). Acquiring knowledge about the social world involves interaction with actions of others. Social reasoning, the process of constructing knowledge about social processes, occurs within a network of relationships and interactions (Durkin, 1988).

Children's experiences in a wide range of contexts forms the basis from which social knowledge and social skills develop. The early relationship with primary caregiver, the interactions and routines of that relationship, have an important role in the development of knowledge about general social interactions (Beveridge & Conti-Ramsden, 1987). Parents continue to influence the acquisition of social knowledge by encouraging social experiences and by giving cues about subtle rules of interactions in new contexts. Once children attend pre-school or school, new rules about the dealing with peers need to be acquired for successful integration. As parents have little influence in these contexts, it appears that the interactions with peers in themselves are used to build knowledge about such interactions (Beveridge & Conti-Ramsden, 1987). For children even without any handicapping conditions, the development of social reasoning skills is a long and difficult process, with no

guarantees for success (Lloyd & Beveridge, 1981). For children with autism, it is likely to be a near impossible task to develop unimpaired social reasoning skills. The early social interactions of autistic children are not ideal for the task of extending their social reasoning abilities. The problems reviewed earlier (section 1.3) in joint attention and social referencing skills in young children with autism will hamper their ability to learn about social situations from their parents, which has a cumulative affect throughout development of social reasoning.

Social reasoning skills therefore have a wide impact on the development of adaptive social behaviour. Proponents of the theory of mind deficit account of autism have suggested that the ability to attribute mental states is one part of general social reasoning but separable from it or logical, non-social reasoning (e.g. Leslie & Thaiss, 1992; Scott & Baron-Cohen, 1996).

There are some experimental findings that appear to support this claim. Scott & Baron-Cohen (1996) found that children with autism were able to successfully solve two types of logical reasoning task yet were impaired in their ability to reason about mental states. Leslie & Thaiss (1992) found evidence that children with autism were able to reason about non-mental representations of the real world (e.g. photographs) but were impaired in their ability to reason about mental representations of the world (e.g. beliefs). However, Zelazo, Burack, Benedetto & Frye (1996) argued that the positive correlation they found between performance on theory of mind tasks and a test of non-social rule use suggested that general reasoning constraints were underlying difficulties with theory of mind.

Klin, Volkmar & Sparrow (1992) found that social deficits in autistic children included behaviours that are normally present in non-autistic infants before the time at which theory of mind skills are thought to develop. Their data were consistent with the suggestion that social impairments in autism occur early in social development and are therefore likely to be related to general social reasoning deficits rather than theory of mind.

1.12 Summary

High-functioning autism and Asperger's syndrome are closely related on the autistic spectrum, and share impairments in social behaviours as central to the disorders. The social impairments seen are not necessarily exclusive to autism, but the pattern of social deficits and preserved abilities runs through the autistic spectrum. The theory of mind hypothesis (e.g. Baron-Cohen et al, 1985) suggests that a deficit in this ability is underlying social impairments in autism. In a series of experiments, Baron-Cohen and colleagues (Baron-Cohen et al, 1985; Baron-Cohen, 1989b; Baron-Cohen, 1991; Holroyd and Baron-Cohen, 1993) have demonstrated that a large proportion of children with autism are both deviant and delayed in the development of an understanding of mental states. There is some evidence that deficits in theory of mind vary across the autistic spectrum. Both chronological age and verbal ability influence success or failure on theory of mind tasks. Use of alternative strategies, general social reasoning deficits and weak central coherence have also been proposed to influence theory of mind task performance (e.g. Happé, 1994) and theory of mind abilities in everyday life (e.g. Frith, 1989). There is some empirical evidence that certain social skills are strongly related to theory of mind ability (Lalonde and

Chandler, 1995), and that these social skills alone are missing from the repertoire of autistic children who fail theory of mind tasks (Frith, Happé & Siddons, 1994). However, the presence of mentalist social skills can vary even amongst those children with autistic spectrum disorders who can succeed on theory of mind tasks (Frith et al, 1994).

The broad research goals of the current study are therefore to examine further the link between theory of mind task performance and everyday social behaviour by including tasks that will allow more detailed examination of strategies being used by children with high-functioning autism and a measure of general social reasoning ability.

1.13 Aims of Current Study

One of the aims of the current study was to replicate the findings of Bowler (1992) and others (e.g. Sparrevohn & Howie, 1995) of theory of mind task success in children with autistic spectrum disorders. The children's justifications for their responses to the false belief questions of the tasks were of special interest, as these justifications were to be examined for evidence of the reasoning underlying the responses. In particular, evidence of mental state reasoning in those children who pass theory of mind tasks was of interest.

A second aim was to compare performance on classic theory of mind tasks with more naturalistic tasks of mentalising ability. An association between the performance on the two types of task would suggest that related abilities are required

to accomplish both (Happé, 1994). In particular, the responses the autistic children gave to justify story characters' actions were to be examined for evidence of mental state reasoning or other reasoning strategies and compared to responses to classic theory of mind tasks.

A third aim of the current study was to examine the relationship between general social reasoning and theory of mind ability. A positive association between the two different reasoning tasks would be consistent with the suggestion that impairments in theory of mind are not restricted to the understanding of mental states, but derive from general social reasoning limitations (Zelazo et al, 1996). If the social reasoning task used in this study is a measure of a more general social reasoning ability that underlies theory of mind, then if a child is at a pre-reasoning stage of development, that child should not be able to solve theory of mind tasks. If any child could solve theory of mind tasks yet not demonstrate social reasoning, this would be inconsistent with the suggestion that a general reasoning difficulty underlies theory of mind.

One of the main aims of the current study was to replicate and extend the findings of Lalonde & Chandler (1995) and Frith et al (1994): to find a relationship between theory of mind task performance and everyday mentalising ability and to discover which social skills of children with autism are related to attaining 1st order or 2nd order theory of mind ability. In addition, to find evidence of at least two different groups of theory of mind 'passers' as Frith et al (1994) described: some children who pass theory of mind tasks will show similar (infrequent) mentalising ability in everyday life to those who fail theory of mind tasks. The second group will show moderate to high levels of mentalist social skills.

A further aim was to examine the relationship between everyday social skills and the use of mental state terms when reasoning about social behaviour by examining autistic children's use of mental state terms in naturalistic theory of mind tasks and social reasoning tasks. This would provide an opportunity to examine responses to such tasks for evidence of insight or understanding of mental state terms used. It would be possible for children to use mental state terms without showing mentalist social skills if a compensatory strategy had been learned.

1.14 Hypotheses

A. Theory of Mind and Strange Stories

- A.1. Performance on classic theory of mind tasks will be correlated with the use of mental state terms in Justification responses in the Strange Stories.
- A.2. Children in the no theory of mind group will not use mental state terms in Justifications in the Strange Stories.
- A.3. Only children with 1st or 2nd order theory of mind ability will use mental state terms in Justifications.
- A.4. Children with 2nd order ability will use more mental state terms in Justification than children in the 1st order group.

B. Theory of Mind and Social Reasoning

- B.1. Performance on classic theory of mind tasks will be related to social reasoning ability.
- B.2. Children with pre-reasoning social reasoning skills will not demonstrate theory of mind ability.

- B.3. No child who passes theory of mind tasks will be at the pre-reasoning stage of social reasoning.
- B.4. Children with 1st order theory of mind ability will have Level 1 social reasoning ability (“immediate consequences”).
- B.5. Children with 2nd order theory of mind ability will show Level 2 or higher social reasoning skills (at least “partial reasoning” ability).
- B.6. Only children with 1st order theory of mind ability or higher will identify or use themes relating to emotions (1st order mental states) in responses to social reasoning questions.
- B.7. Only children with 2nd order theory of mind ability will identify or use 2nd order mental states or elaborations in responses to social reasoning questions.
- B.8. There will be no differences between the theory of mind groups on identification and use of physical states, value judgements and rules in responses to social reasoning questions.

C. Theory of Mind and Social Skills (see Appendix 1)

- C.1. Children who fail theory of mind tasks will show no evidence of using mentalist social skills in everyday life.
- C.2. Only children with 1st order theory of mind ability or higher will show evidence of mentalist social skills in everyday life.
- C.3. Only children with 2nd order theory of mind ability will show evidence of mentalist social skills requiring 2nd order theory of mind ability.
- C.4. There will be no differences between the theory of mind groups in performance of non-mentalist social skills.



D. Strange Stories and Social Skills (see Appendix 1)

- D.1. The use of mental state terms in Justification responses will be associated with use of mentalist social skills in everyday life.
- D.2. Only children who use mental state terms in Justification responses will show mentalist social skills in everyday life.
- D.3. There will be no difference between those children who do and do not use mental state terms in performance of non-mentalist social skills.

E. Social Reasoning and Social Skills (see Appendix 1)

- E.1. The identification and use of mental states in responses to social reasoning questions will be associated with the performance of mentalist social skills in everyday life.
- E.2. Only children who identify and use 1st order or 2nd order mental states in social reasoning responses will show mentalist social skills.
- E.3. Only children who identify and use 2nd order mental states in social reasoning responses will perform 2nd order mentalist social skills.
- E.4. There will be no difference between those who do or do not use or identify mental states in social reasoning responses in performance of non-mentalist social skills.

F. Chronological and Verbal Mental Ages

- F.1. There will be no significant differences in mean chronological age between groups separated on the basis of performance on theory of mind tasks, the Strange Stories and social reasoning tasks.

F.2. As the participants have been pre-selected to have a minimum level of verbal ability, there will be no significant differences in mean verbal mental age between groups separated on the basis of performance on theory of mind tasks, the Strange Stories and social reasoning tasks.

CHAPTER 2: METHOD

2.1 Design

Children with autistic spectrum disorders were separated into groups on the basis of (i) performance on classic 1st order and 2nd order theory of mind tasks, (ii) performance on a social reasoning task and (iii) the use of mental state terms in Justifications to the “Strange Stories”. The pattern of everyday social skills was compared across each category of groups in unrelated designs. Performances on each of the three main types of task (theory of mind; social reasoning; Strange Stories) were also compared across respective group conditions in unrelated designs.

Qualitative analyses of participants’ responses to (i) classic 1st order and 2nd order theory of mind tasks, (ii) the social reasoning task and (iii) the “Strange Stories” were made with reference to everyday social behaviour and performance on the respective tasks.

2.2 Participants

The participants were either current or past patients of one of two child and family mental health departments. The children and their parents participated voluntarily in this study. For the majority of participants, the reason for initial contact with the psychology or psychiatry departments was for diagnostic assessment. The children had been diagnosed with high-functioning autism or Asperger’s Syndrome by experienced clinicians. Criteria for inclusion in this study were:

1. children between the ages of eight and seventeen,
2. with a diagnosis of high-functioning autism or Asperger’s Syndrome,

3. with an estimated verbal ability of at least five years of age.
4. In addition, the child could not have a co-morbid diagnosis of Tourette's or Attention Deficit Disorder.

A minimum age of eight was set as the majority of non-autistic children can successfully complete 2nd order theory of mind tasks by this age. This would exclude failure at any level of theory of mind ability by autistic children being due to normal developmental processes.

A wide age range provided the opportunity to examine developmental trends across the participants, but a maximum age of seventeen was set to ensure a balance between that and the desire to examine the social abilities of *children* only. Social context and experience have a significant impact on social behaviour. As all of the participants were in mainstream schools, at age seventeen their lifestyles and main occupations were still school-age based. Additionally, the age range reflected the standardisation range of the measures used.

Each child's verbal ability was initially estimated by their consultant to be at least five years of age. This was to exclude the possibility of general learning disability or lack of comprehension of the task as a reason for failure.

Using the above criteria, 28 children were identified and contacted by letter (see Appendix 2), and where possible by their consultant, to inform them of the study (see Appendix 3) and to ask for their participation. Parents and children who initially

expressed interest in the study in response to the letter, were given the opportunity to gather more information about the study either by telephone or face to face contact. Assessment proceeded only after the informed consent of both parents and child was received. The children were assessed in an environment of their choice that was familiar to them – the majority were seen at home and some were seen at school.

2.3 Materials

1st Order Theory of Mind

Sally-Anne Test (Baron-Cohen et al, 1985). This false belief task, a version of the task devised by Wimmer & Perner (1983), examines 1st order theory of mind ability. Two easily distinguishable hand puppets, a round red box, a square blue box (both boxes with lids), and a large marble were used to act out the scenario as described in Baron-Cohen et al (1985). One small change was made from the original procedure – one puppet was dressed as a boy and was therefore called Andy instead of Anne. See Figure 2.2 in Procedure section below.

“Smarties” Test (Perner et al, 1989). This is also a 1st order false belief task. An empty tube of “Smarties” and two colour pencils were used to act out this scenario (see Procedure section below).

2nd Order Theory of Mind

Ice Cream Van Story (Baron-Cohen, 1989b). This story, adapted by Baron-Cohen (1989b) from Perner & Wimmer’s (1985) procedure, was designed to elicit evidence of 2nd order theory of mind ability. The story takes place in a toy village with a church, two houses, a park bench and Lego trees to prevent the characters ‘seeing’

the church or John's house from the park, four Mobile people and a Lego ice cream van (see Figure 2.1 and Appendix 4).

Birthday Puppy Story (Tager-Flusberg & Sullivan, 1994). This 2nd order false belief story was developed to have lower information-processing demands than the Ice Cream Van Story above, as the authors hypothesised that the added information-processing load of 2nd order tasks (in comparison to 1st order tasks) was the cause of autistic children's failure on these tasks. Tager-Flusberg & Sullivan (1994b) reported a larger proportion of their participants who passed a 1st order task also passed this 2nd order task. This form of 2nd order task appears to facilitate autistic children's success at 2nd order attribution in comparison to the Baron-Cohen (1989b) task. See Appendix 5.

"Naturalistic" Theory of Mind

Strange Stories (Happé, 1994). The Strange Stories were developed to be more naturalistic tasks than classic theory of mind tests. The set of Strange Stories consists of 24 short stories about everyday situations where people say things they do not mean literally. Each story is accompanied by a picture and a comprehension question, "Was it true, what X said?" and a justification question, "Why did X say that?" There are 12 types of story, comprising Pretend, Lie, Joke, White Lie, Idiom, Misunderstanding, Double Bluff, Sarcasm, Persuasion, Contrary Emotion, Appearance/Reality and Forget (see Appendix 6 for the stories used in the current study). The scoring system used in Happé (1994) was followed, which classified each answer as appropriate or incorrect, and as concerning psychological/mental states or physical states. This last score was used in this study as a reflection of

social reasoning ability. Each child was given credit only for his/her ‘best’ answer when scoring each story. Despite the subjective judgements required to score the justifications, reliability has been reported to be high (Happé, 1994).

Social Reasoning

Social Reasoning (Elliott, Murray and Pearson, 1978). This is a subtest of the British Ability Scales (BAS), which was standardised on the data from 3435 British children. The social reasoning subtest was designed to be used to estimate developmental stages in social reasoning. Responses are scored according to 5 levels of reasoning ability: pre-reasoning, immediate consequences, partial evaluation, full evaluation and generalised comment (see Table 2.1). The estimated developmental stage for the child is the *median* of the item scores. The apparent subjectiveness of rating responses on this test is tempered by extensive descriptions and examples as guidance. This is standardised and validated for British children from age 5 to 17½ years. See Appendix 7.

Table 2.1 The five developmental stages of social reasoning from the British Ability Scales.

DEVELOPMENTAL STAGE	MAJOR CHARACTERISTICS
Pre-Reasoning	Child unable to comprehend what is required or provide a relevant response.
Immediate Consequences	Relevant responses in terms of immediate reactions or consequences; focus on punishment/reward of one person only. No further elaboration
Partial Evaluation	Broader grasp of one side of the problem only; value judgements; statements of simple rules of behaviour; no view of both sides of story.
Full Evaluation	Reasons and explanations for the actions of both characters; some value judgements but with reference to all sides; may provide elaboration.
Generalised Comment	Child sees the problem as an example of general difficulties; broader statements about types of situations and people.

Social Skills

Vineland Adaptive Behavior Scales (Sparrow et al, 1984). This measure of social behaviour has the advantage of being standardised and validated for non-handicapped and handicapped populations, as well as being perhaps the most widely used assessment tool in studies of socialisation. Only the Socialisation Domain of the Interview Edition: Expanded Form was administered in this study (see Appendix 8). This contains 134 items designed to assess strengths and weaknesses across a wide range of social behaviours. Internal consistency reliability for the Socialisation Domain of the Expanded Form ranges from 0.88 to 0.97, and from 0.84 to 0.86 for the Interpersonal Relationships, Play and Leisure Time and Coping Skills subdomains of the Socialisation Domain (Sparrow et al, 1984). Test-retest reliability coefficients fall in the range of 0.80 to 0.92 (Sparrow et al, 1984). Further analyses have demonstrated that the Vineland is a valid instrument in terms of face, content, predictive and construct validity (Sparrow et al, 1984).

Each item on the scale can be rated from 0 to 2. A score of 0 is given if the individual rarely or never performs the behaviour (even if they *can*), 1 indicates that the behaviour is sometimes or partially performed, and 2 indicates that the behaviour is (or has been at the appropriate age) regularly and adequately performed. The question is whether the individual *does* perform the behaviour rather than if they *can* do the behaviour.

In addition to the standard method of using the Vineland Adaptive Behavior Scales, social skills items which only appeared possible if an understanding of mental states

was present were identified, as well as clusters which seemed possible without such understanding. Very strict criteria were given to the clinicians who were rating the items: if any other way apart from using a theory of mind skill could potentially be used to successfully perform a social skill (e.g. rote learning, conditioned response), it was not included in the mentalist set. Inter-rater agreement for the mentalist social skills was 88%. A set of sixteen mentalist items was thus formed and 23 clusters of non-mentalist social skills. Three of the sixteen mentalist social skills items were rated (100% agreement) as requiring 2nd order mental state understanding. These three sets of behaviours are shown in Appendix 1.

Verbal Ability

British Picture Vocabulary Scale (Dunn et al, 1982) is a measure of receptive vocabulary and *not* a measure of general intelligence. It has been standardised on a British sample of 3334 school children between three and nineteen years, using the Short Form version of the test. The Short Form comprises 32 items whose internal reliability ranges from 0.75 to 0.86 (Dunn et al, 1982). There are no direct test-retest measures of reliability of the scale, but the standardised score is given as an equivalent age point and range defined by the standard error of measurement. The participants were assessed with this measure to ensure they had a sufficient level of language ability to understand the demands of the experimental tasks.

Diagnostic Screening

Asperger's Checklist (Ehlers & Gillberg, 1993). This screening questionnaire is used to identify children *at risk* for Asperger syndrome (see Appendix 9). It has a

low cut-off point to minimise the chance of missing true positives, which means there is a higher chance of false positives. It is recommended that a second stage of comprehensive clinical assessment is employed to increase the validity of any diagnosis. Further assessment would be recommended for any child with a total score ≥ 5 , or a score ≥ 3 on 16 items considered most characteristic of Asperger Syndrome. Thus, a total score of 9-24 indicates a possible diagnosis of Asperger Syndrome, and a score ≥ 25 an almost definite diagnosis. However, it was not being used as a diagnostic aid in this study, only as a measure of homogeneity of symptoms across the participants. For these purposes, the questionnaire has good levels of reliability (Ehlers & Gillberg, 1993).

2.4 Procedure

Prior to commencing the study, ethical approval was sought and obtained from both the Tayside Committee on Medical Research Ethics and the Lothian Research Ethics Psychiatry/Clinical Psychology Sub-Committee.

The procedure for recruiting participants to the study is described in Section 2.2. After informed consent was obtained, the children were individually interviewed on their own or with a parent present, whichever the child preferred. The interviews with the children were audio taped and their answers scored later. The parents completed the Asperger's Checklist while the experimenter was assessing the child. The Socialisation Domain of the Vineland was completed in a separate, structured interview with the parent, lasting up to 45 minutes.

The first order theory of mind tasks were presented verbally to the children along with the appropriate actions. The other tasks (unless otherwise stated below) were read aloud to each child and the story and test questions in written form were placed in front of the child so that the child could read along with the experimenter, either silently or aloud. The stories were introduced to the children as follows: "Here are some stories and some questions. I'm going to read out the stories and I'd like you to listen carefully and help me with the questions about each story." These instructions could be repeated if necessary before each different task. Positive comments were made throughout the testing session to encourage the participants, but no feedback was given about the correctness of the responses. There was only one trial for each task. The tasks were presented in the same order for all participants, starting with the simpler theory of mind tasks in order to prevent a possible loss of motivation due to initial failure. In order of presentation, the procedure of administering the experimental tasks was as follows:

1. Smarties task. This 1st order theory of mind task was presented using the exact wording and procedure as described in Sparrevohn and Howie (1995, p.255):

The experimenter produces a Smarties box from her bag and asks the child, "What do you think is in here?". "Smarties!", the child answers. The experimenter opens the box and to the child's surprise, the contents are not Smarties but coloured pencils. The experimenter states, "No, look, there are pencils". She puts the pencils back into the box, closes the box, and asks the following two prompt questions:

Reality Prompt: "What's in here?" (correct answer: pencils)

Memory Prompt: "When I first asked you what did you say?" (correct answer: Smarties)

Then the child is asked about a sibling or parent: "S/he hasn't seen this box. When s/he comes in, I'll show her/him this box just like this and ask what's in here?"

Prediction test: "What will (name) say?" (correct answer: Smarties)

Reality check: “Is that what’s really in the box?” (correct answer: no) “What’s really in the box?” (correct answer: pencils)

Memory check: “Do you remember, when I took the box out of my bag and asked you what was in it, what did you say?” (correct answer: Smarties).

Participants had to answer all prompt and check questions correctly, as well as the prediction (false belief) question, to pass this task.

2. Ice cream van story. This 2nd order theory of mind task used the exact wording and procedure as used by Baron-Cohen (1989b). The experimenter laid out a toy village in front of the child (see Figure 2.1). The written form of the story was not placed in front of the child. The experimenter then told the following story, moving the characters and ice cream van accordingly:

This is John and this is Mary. They live in this village.

Naming questions: Which is John?/Mary?

Here they are in the park. Along comes the ice cream man. John would like to buy an ice cream but he has left his money at home. He is very sad. “Don’t worry,” says the ice cream man, “you can go home and get your money and buy some ice cream later. I’ll be here in the park all afternoon.” “Oh, good” says John, “I’ll be back in the afternoon to buy an ice cream.”

Prompt question 1: Where did the ice cream man say to John he would be all afternoon?

So John goes home. He lives in this house. Now, the ice cream man says, “I am going to drive my van to the church and see if I can sell my ice creams outside there.”

Prompt question 2: Where did the ice cream man say he was going?

Prompt question 3: Did John hear that?

The ice cream man drives over to the church. On his way, he passes John’s house. John sees him and says “Where are you going?” The ice cream man says, “I’m going to sell some ice cream outside the church.” So off he drives to the church.

Prompt question 4: Where did the ice cream man tell John he was going?

Prompt question 5: Does Mary know that the ice cream man has talked to John?

Now Mary goes home. She lives in this house. Then she goes to John's house. She knocks on the door and says "Is John in?" "No," says his mother, "he's gone out to buy an ice cream."

Belief question: Where does Mary think John has gone to buy an ice cream?

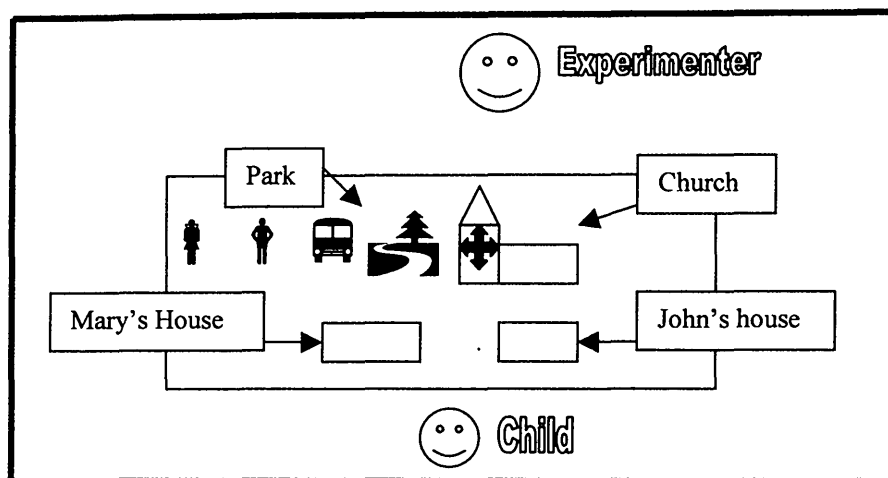
Justification question: Why?

Reality question: Where did John really go to buy his ice cream?

Memory question: Where was the ice cream man in the beginning?

Participants had to answer all prompt questions and the false belief question correctly to pass this task.

Figure 2.1. Scenario at start of Ice cream Story.

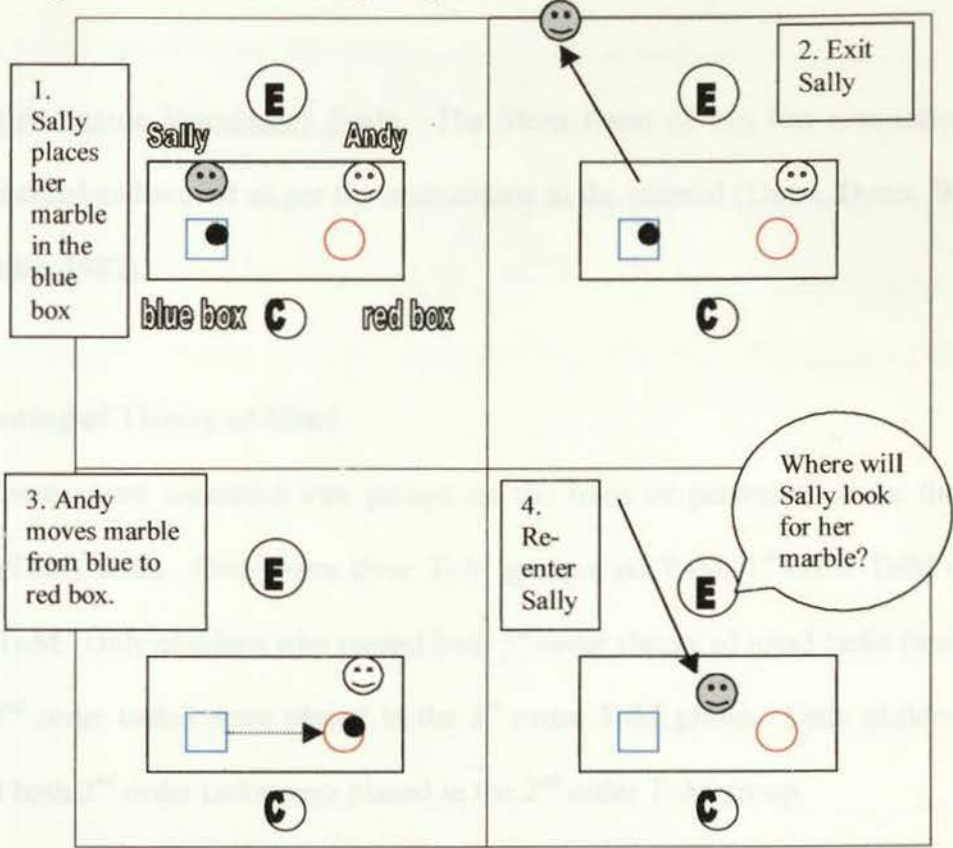


3. Strange Stories. The children were presented with one example of each story type (12 stories in total). All the children were presented with the same set of stories and in the same order (as listed above in Materials section). Some examples of Strange Stories can be found in Appendix 6.

4. Sally-Andy task. This 1st order theory of mind task was presented using the procedure as described in Baron-Cohen (1989a). See Figure 2.2. In addition to the false belief question, "Where will Sally look for her marble?", the children were

asked memory and reality control questions (“Where was the marble in the beginning?” and “Where is the marble really?”). The participants passed this task only if these control and belief questions were answered correctly and the child demonstrated s/he could name the puppets correctly.

Figure 2.2. Scenario of Sally-Andy test.



5. Birthday Puppy Story. This 2nd order story was presented without any displays or props, although the written form of the story was placed in front of each child and they were encouraged to read along with the experimenter, either silently or aloud. The wording was changed slightly from the version in Tager-Flusberg and Sullivan (1994b) to facilitate the present study’s British participants’ understanding of the story. The word ‘basement’ was replaced with the word ‘garage’ and the word ‘Mom’ replaced with ‘Mum’. The participants only scored a pass on the 2nd order

false belief question if all control and ignorance questions were answered correctly. The full story as used in this study is reproduced in Appendix 5.

6. Social Reasoning subtest of the BAS. This subtest was introduced, administered and scored as per the instructions in the manual (Elliot, Murray & Pearson, 1978).

7. British Picture Vocabulary Scale. The Short Form of this test was introduced, administered and scored as per the instructions in the manual (Dunn, Dunn, Whetton & Pintilie, 1982).

2.5 Scoring of Theory of Mind

Participants were separated into groups on the basis of performance on theory of mind (ToM) tasks. There were three ToM groups: no ToM, 1st order ToM and 2nd order ToM. Only children who passed both 1st order theory of mind tasks (and failed both 2nd order tasks) were placed in the 1st order ToM group. Only children who passed both 2nd order tasks were placed in the 2nd order ToM group.

The participants were also given a theory of mind score. This score was a more inclusive measure of theory of mind ability as credit was given for all tasks passed. For example, the children who passed only one 1st order task were placed in the no ToM group using the above method, and their success on one task was effectively ignored. The ToM Score included this important information about theory of mind ability. The ToM Score ranged from 0 to 4.

2.6 Scoring of Strange Stories Justifications.

The justifications of responses to Strange Stories were categorised firstly as correct or incorrect, and secondly as either involving mental state terms or physical/logical terms. A justification could be incorrect because it was factually wrong or because it was inappropriate in the context of the story. Justifications were scored as mental state when they referred (implicitly or explicitly) to thoughts, feelings, desires, traits and dispositions. Physical/logical justifications included those that referred to non-mental events – how things looked, physical events, actions of objects, etc. If the participant gave more than one response, they were given credit for their best answer – a mental state answer ‘trumped’ a physical/logical answer. Examples of answers in each category of response are given in Appendix 10.

2.7 Scoring of Social Reasoning Responses

As well as the developmental stage of social reasoning being assessed by this test, the participants’ responses on this subtest were examined for use of four categories of phrases or terms: Physical Consequences, Emotions, Value Judgements and Elaboration of Story. The Emotions and Elaboration of Story were mental state categories and the Physical Consequences and Value Judgements were non-mental state categories.

2.8 Data Analysis

Data were analysed using SPSS Version 8.0 for Windows. Non-parametric tests were used throughout the analysis due to the small number of participants in this study. As non-parametric tests (or distribution-free tests) make relatively few

assumptions about the nature of the data population, they are ideal for small data sets where assumptions of normality may not be met. Since there were very few instances of missing data, they were not pro-rated but remained missing. Between groups statistical procedures were mainly either Jonckheere-Terpstra (3 independent groups) or Mann-Whitney (2 independent groups). For analysis of two related groups, the Wilcoxon statistical procedure was used. The Spearman correlation test was used when associations between variables were examined. Where chi-square tests were utilised, the Fisher's exact test was used if any cell had an expected count of less than five.

Significance levels were set at 0.05. Although non-parametric tests were used, SPSS automatically fits the data to a normal approximation when calculating significance. Therefore, the Exact Significance was used. This significance level is based on the exact distribution of the data rather than a normal approximation, and is particularly useful when the data set is relatively small and could possibly contain many ties. These were used except where multiple statistics were being performed on a single group of variables (e.g. theory of mind levels). In those cases, Bonferroni corrections were used to adjust significance levels. In practice, this meant a significance level of 0.016 was used for Mann Whitney comparisons on the three theory of mind levels or three social reasoning levels.

CHAPTER 3: RESULTS

3.1 Participants

Of the 28 children and parents contacted, nineteen replied to the initial contact letter. Two of those subsequently dropped out. Therefore, seventeen children (16 male, 1 female) with high-functioning autism or Asperger's Syndrome participated in this study. The majority (82%) of the children in this study had a diagnosis of Asperger's syndrome and only 18% had a diagnosis of high-functioning autism. There was no significant difference between these diagnostic groups on total scores of the Asperger's Checklist ($z = -0.435$, ns). There was also no significant difference on the scores for the sixteen items of the Checklist considered most characteristic of Asperger's syndrome ($z = -0.654$, ns). Both these results indicated that behavioural and diagnostic features were homogenous across participants.

3.2 Chronological Age

The children were aged between 7 years 2 months and 17 years 2 months (mean 11 years 11 months, $s.d. = 2.55$). When participants were separated on the basis of theory of mind (ToM) performance, there were no differences of mean chronological age between the groups ($J-T = 1.597$, ns). Similarly, there were no significant differences of mean chronological age when participants were separated on the basis of social reasoning performance ($J-T = 0.545$, ns), or use of mental state terms in Strange Stories Justifications ($z = -0.963$, ns).

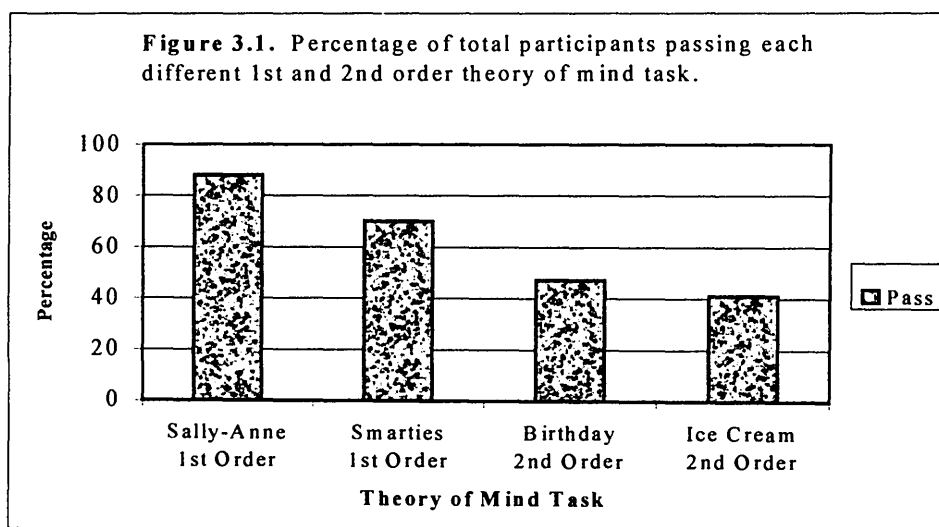
3.3 Verbal Mental Age

The mean verbal mental age of all the children participants was 9 years 1 month ($s.d. = 2.44$, range from 4 years 5 months to 13 years 10 months). The verbal mental age of two children was below the preferred limit of 5 years. However, as normal

children are able to successfully pass at least 1st order theory of mind tasks at age 4, a verbal mental age of 4 years 5 months should be sufficient to exclude the possibility that failure is due to poor language ability.

3.4 1st Order Theory of Mind Ability

All children passed all control questions. 18% of the participants failed one of the 1st order ToM tasks and a further 12% failed both 1st order ToM tasks. Participants were required to pass both theory of mind tasks to be credited with 1st order ToM ability. Therefore, 76% of the participants successfully demonstrated 1st order theory of mind ability (one child who failed the “Smarties” task passed both 2nd order tasks and so was placed in the 2nd order group). Of all the participants, 88% passed the Sally-Anne task and 70% the “Smarties” task. There were no significant differences between the numbers of passers and failers between the tasks (Fisher’s Exact Test, $\chi^2_1 = 5.44$, ns). See Figure 3.1 below for comparison with success on 2nd order tasks.



3.5 2nd Order Theory of Mind Ability

6% of the participants failed one 2nd order ToM task and a further 53% failed both 2nd order tasks. Participants were required to pass both 2nd order ToM tasks to be

credited with 2nd order theory of mind ability. Therefore, 41% of the participants successfully demonstrated 2nd order theory of mind ability (the one child who failed the Ice Cream Van task and passed the Birthday Puppy task was placed in 1st order ToM group as he had passed both 1st order tasks). See Figure 3.1 above for comparison with success on 1st order tasks.

Justifications to Ice Cream Van Story

Two of the seven children who passed this task explicitly used 2nd order mental state justifications for their answers (“because she doesn’t know that John knows the ice cream man is at the church”). Three of the justifications referred to the point in the story where the false belief is set up (“because that’s where he told John he would be all afternoon”). In these responses it is implicit that these are Mary’s beliefs about John’s knowledge. One participant’s justification was incorrect in the context (“because she wasn’t told that he was going to be at the church”) and one did not give a justification.

Incorrect responses to the false belief question of the Ice Cream Van Story were justified in three instances with reference to Mary’s knowledge only (“because Mary knows it’s there”; “because the ice cream man told her he was going to the church”). Three other justifications focussed on the physical presence of the van at the church (“because that’s where it is”). Four who failed the task did not give any justification.

Justifications to Birthday Puppy Story

One of the eight children who passed this task used a justification that was explicitly 2nd order (“because she doesn’t know that he knows”) and one used an implicit 2nd

order justification (“Mum thinks that Peter hasn’t seen the puppy”). Two responses focussed on information communicated in the story (“because she told Peter she had got him a toy”) and three focussed on the deception being employed in the story (“Mum wants to keep it a secret”). One justification was incorrect in the context.

Three who failed this task did not give a Justification. Four children answered the 1st order ignorance question incorrectly and therefore answered the false belief question correctly but for the wrong reasons. Their Justifications centred on the deception. Two Justifications of the children who failed this task were incorrect in the context.

3.6 Summary of Theory of Mind Ability

In total, 24% (4) of the participants failed to demonstrate either 1st or 2nd order ToM ability; 35% (6) were limited to 1st order ToM ability; and 41% (7) demonstrated 2nd order ToM ability.

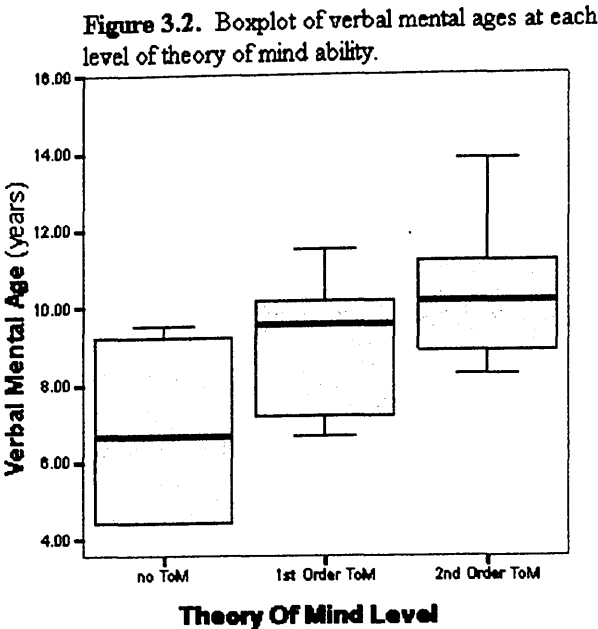
Participants were also given a total theory of mind score from 0 to 4, comprising of the total number of theory of mind tasks passed. As can be seen in Table 3.1, the majority (64.7%) of children who passed one task at a particular theory of mind level passed them both, achieving scores of 2 or 4. However, some participants scored 1 or 3, indicating that they passed one task only at a particular theory of mind level. See Table 3.1 for the spread of scores across all participants.

Table 3. 1. Percentage and number of all participants’ theory of mind scores.

	Theory of Mind Score				
	.00	1.00	2.00	3.00	4.00
Percent	11.8%	11.8%	29.4%	11.8%	35.3%
Count	2	2	5	2	6

3.7 Verbal Mental Age and Theory of Mind Ability

There was a significant trend for differences in verbal ability across the three theory of mind groups (no theory of mind, 1st order, 2nd order) (J-T=2.00, p<0.05). Success



on theory of mind tasks was positively correlated with verbal mental age, and the correlation was significant ($r=0.549$, $p<0.05$). There was notable overlap of verbal ability across the three groups (see Figure 3.2 and Table 3.2 below). The mean verbal mental age was not

significantly different between any two groups (using Bonferroni corrections for multiple comparisons): no theory of mind and 1st order ($z=-1.39$, ns); no ToM and 2nd order ($z=-1.80$, ns); 1st order and 2nd order ($z=-0.94$, ns).

Table 3.2. Mean and range of chronological and verbal mental ages for different levels of theory of mind attainment.

			Age (Years:Months)	Verbal Mental Age (Years:Months)
Theory Of Mind Level	No ToM	Mean	11:3	6:10
		Range	8:9-15:8	4:5-9:6
	1st Order ToM	Mean	10:10	9:1
		Range	7:2-13:4	6:8-11:6
	2nd Order ToM	Mean	13:3	10:4
		Range	11:4-17:2	8:3-13:10

3.8 “Strange Stories”

The majority (88%) of the participants had a total Comprehension score of 9 or more (the maximum score being 12). One child failed to give any answers to the Strange Stories and was excluded from further analysis of this test.

All of the remaining participants used mental state Justifications for at least some of their responses. The number of mental states used in Justifications (correct and incorrect) range from two to eleven (out of twelve). The number of physical state answers ranged from one to ten (out of twelve).

The participants were separated into groups on the basis of use of mental states in Justifications. Low use was defined as scores one standard deviation or more below the mean. Moderate scores were within one standard deviation of the mean, and High scores were one standard deviation or more above the mean. This meant that 31% (5) were in the Low use group and 69% (11) in the Moderate use group. There were no participants in the High use group as there was a ceiling effect: the maximum score possible was 12 and the highest score achieved was 11 and this was within the “moderate” range. There were no significant differences in mean verbal mental age between the Low and Moderate use groups ($z=-0.741$, ns).

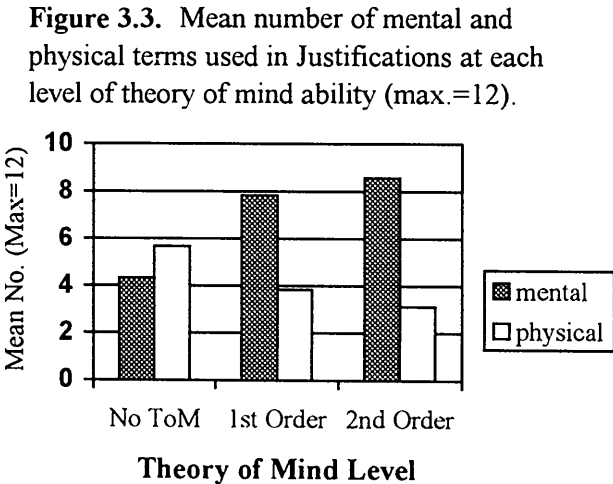
Table 3.3. Mean number of (i) overall and (ii) correct mental and physical state responses to Justifications on Strange Stories for groups separated by proportion of mental states used.

	Low and High Use of Mental Justifications Groups	
	Low	High
	Mean	Mean
Overall Mental Justifications	4.20	9.00
Overall Physical Justifications	6.20	2.82
Correct Mental Justifications	2.20	6.82
Correct Physical Justifications	2.20	2.18

Table 3.3 above shows the mean number of overall mental and physical state Justifications and mean number of *correct* mental and physical Justifications for Low and Moderate use groups.

3.9 Theory of Mind and “Strange Stories”

Theory of mind scores were significantly and positively correlated with total Justification scores for the Strange Stories ($r=0.77$, $p<0.05$). ToM score was not associated with overall use of mental state justifications ($r=0.41$, ns), but was positively and significantly correlated with *correct* mental justifications ($r=0.56$, $p<0.05$). This correlation between correct mental state justifications and theory of mind ability remained significant even when correcting for verbal ability ($r=0.51$, $p<0.05$). The mean number of mental state terms *per se* did not differ significantly between the three ToM groups ($J-T=1.66$, ns). However, correct mental state



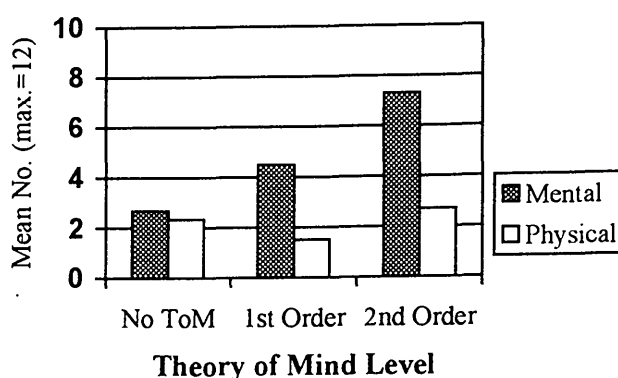
explanations for characters’ utterances in the Stories was significantly different across the three groups ($J-T= 2.43$, $p<0.05$). Figure 3.3 shows how the use of mental state terms increased with increasing theory of mind

ability. Even those who failed to demonstrate any theory of mind ability still used mental state terms in their answers. The children with 2nd order theory of mind ability used significantly more mental state terms in the correct context than children

with 1st order ($z=-2.11$, $p<0.05$) or no ToM ability ($z=-2.33$, $p<0.05$). Figure 3.4

shows how the *correct* use of mental and physical state terms in Justification answers varied across the three theory of mind groups.

Figure 3.4. Mean number of correct mental and physical Justifications at each level of theory of mind ability.



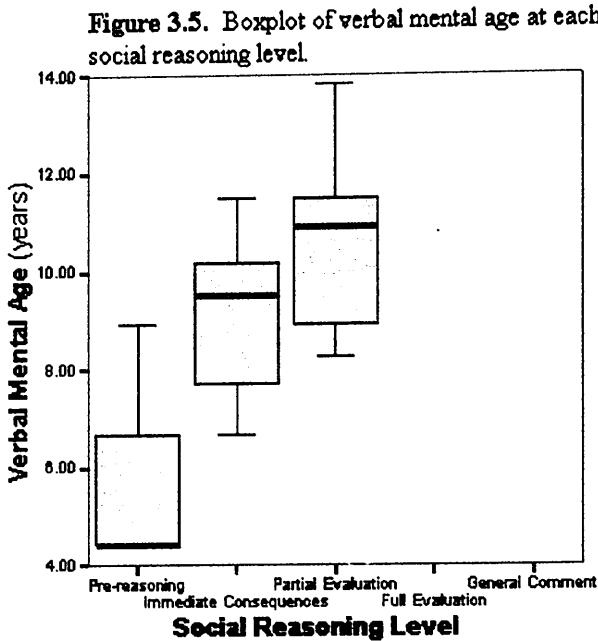
3.10 Social Reasoning

There were five levels of social reasoning ability that could potentially be demonstrated by the children in this study. At least 50% of normal children between the ages of seven and seventeen would be expected to achieve at least level 2 (“partial evaluation”). However, none of the participants in this study achieved levels of social reasoning ability higher than level 2. 19% of the participants were judged to be at a pre-reasoning level (level 0) of social reasoning, and the largest proportion of participants (50%) were limited to level 1 social reasoning (“immediate consequences”). All of these were below the 5th percentile for their chronological age. The rest (31%) achieved level 2 (“partial evaluation”), which were average levels of social reasoning ability for their chronological ages.

When compared to verbal mental age rather than chronological age, twice the number (62%) of autistic children had achieved average levels of social reasoning ability, indicating that the majority of participants’ social reasoning ability was in keeping with the rest of their cognitive abilities.

3.11 Verbal Mental Age and Social Reasoning

There was a significant trend for differences in verbal ability across the three social reasoning groups (pre-reasoning; immediate consequences; partial evaluation) (J-T=



2.289, $p<0.05$). Performance on social reasoning tasks was positively correlated with verbal mental age, and the correlation was significant ($r=0.559$, $p<0.05$). There was overlap of verbal ability across the three groups (see Figure 3.5 and Table 3.4).

The mean verbal mental age was not significantly different between any two groups (using Bonferroni corrections for multiple comparisons): “pre-reasoning” and “immediate consequences” ($z=-1.85$, ns); “pre-reasoning” and “partial evaluation” ($z=-1.81$, ns); “immediate consequences” and “partial evaluation” ($z=-1.18$, ns).

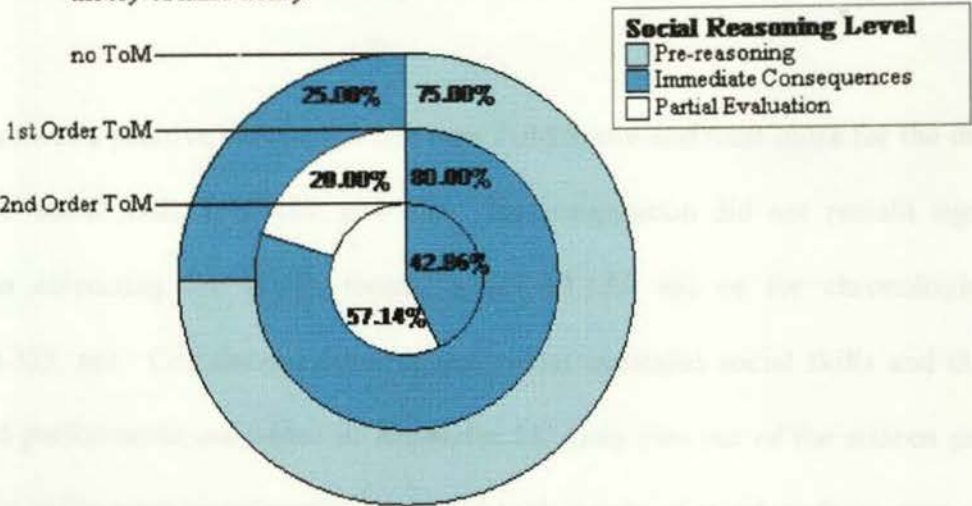
Table 3.4. Mean and range of chronological and verbal mental ages for different levels of social reasoning attainment.

			Age (Years:Months)	Verbal Mental Age (Years:Months)
Social Reasoning Level	Pre-reasoning	Mean	11:6	5:11
		Range	8:9-15:8	4:5-8:11
	Immediate Consequences	Mean	12:7	9:1
		Range	10:2-17:2	6:8-11:6
	Partial Evaluation	Mean	12:1	10:8
		Range	9:2-14:10	8:3-13:10

3.12 Theory of Mind and Social Reasoning

There were significant differences in mean ToM score between the groups of children defined by level of social reasoning ability ($J-T=2.93, p<0.05$). The children with level 0 (pre-reasoning) social reasoning were significantly poorer at theory of mind tasks than those with “immediate consequences” or “partial evaluation” reasoning ability ($z=-2.438, p<0.05$). Higher levels of social reasoning ability were associated with greater success on ToM tasks ($r=0.715, p<0.05$). This association between social reasoning and theory of mind ability remained significant even when correcting for verbal ability ($r=0.574, p<0.05$).

Figure 3.6. Pie chart of distribution of social reasoning levels at each level of theory of mind ability.



The majority (75%) of children in the No ToM group were at the pre-reasoning developmental stage of social reasoning. As can be seen in Figure 3.6 above, autistic children with 1st order or 2nd order ToM ability all achieved at least the “immediate consequences” level of social reasoning, and the proportion with level 2 (partial evaluation) increased with higher order theory of mind attainment.

3.13 Theory of Mind and Social Skills

From a total possible score of 32 on the mentalist items, children who passed 1st or 2nd order tasks achieved scores ranging from 2 to 18; none of the children who passed 2nd order tasks achieved a score lower than 11. The children in the no ToM group scored between 0 and 13. There were significant differences between the three ToM groups' mean total scores on the set of sixteen mentalist social skills ($J-T=2.165$, $p<0.05$). Using Bonferroni corrections for multiple comparisons, there were no significant differences in total mentalist scores between the no ToM and 1st order groups ($z=-0.130$, ns), or between the no ToM and 2nd order groups ($z=-1.50$, ns). The 2nd order group had significantly higher mean total mentalist scores than the 1st order group ($z=-2.158$, $p<0.016$).

There was a positive correlation between ToM Score and total score for the mentalist set of social skills ($r=0.489$, $p<0.05$). This association did not remain significant when correcting for verbal mental age ($r=0.377$, ns) or for chronological age ($r=0.325$, ns). Correlations between individual mentalist social skills and theory of mind performance are tabled in Appendix 11. Only two out of the sixteen mentalist social skills were significantly correlated with theory of mind performance: controls anger at constructive criticism ($r=0.443$, $p<0.05$); apologies for unintentional slights ($r=0.510$, $p<0.05$).

Nine out of sixteen of the social skills judged to require theory of mind ability were shown by children in the no theory of mind group. Four of the mentalist (1st order) social skills were shown only by children with 1st or 2nd order theory of mind ability

(controls anger at constructive criticism; apologises for unintentional slights; apologises for mistakes; imitates a complex task several hours after). For one of the non-mentalist social skills clusters (Belonging to Groups), a score above zero was only seen in children with 1st order ability or above. None of the 2nd order mentalist social skills were seen exclusively in children with 2nd order theory of mind ability. The majority of non-mentalist social skills clusters were seen in children across all three theory of mind groups.

3.14 “Strange Stories” and Social Skills

Autistic children who used Moderate levels of mental state Justifications achieved higher mean total scores on the set of mentalist social skills than children in the Low use group ($z=-2.557$, $p<0.05$). The total score of mentalist social skills performed in everyday life was associated with the use of mental state Justifications ($r=0.511$, $p<0.05$) and this association remained positive and significant when correcting for verbal mental age ($r=0.482$, $p<0.05$). There was also an association between *correct* mental state Justifications and total score of mentalist social skills ($r=0.782$, $p<0.05$), which remained positive and significant when correcting for verbal mental age ($r=0.637$, $p<0.05$).

The use of mental states in Justification responses was significantly correlated with use of only three out of the sixteen individual mentalist social skills (see Appendix 11). The same three mentalist social skills and two further mentalist social skills were significantly associated with the correct use of mental states in Justifications. Only children who used a moderate proportion of mental state terms in Justifications showed those same five mentalist social skills. All other social skills (both mentalist

and non-mentalist) were shown by children with moderate and low use of mental state terms in Justifications.

3.15 Theory of Mind & Themes Identified in Social Reasoning Task

Physical Consequences

The identification of Physical Consequences for the main protagonist's actions was very similar across the three theory of mind groups (no ToM; 1st order ToM; 2nd order ToM). Children from all three groups consistently pointed out, appropriately, that the main characters would "get into trouble" for their actions. However, that physical hurt may be inflicted as a result of a character's actions was only recognised by children with 1st or 2nd order theory of mind ability. Only one child from the no ToM group exclusively used physical consequences in social reasoning responses; all other children used more than one category of response.

Emotions

Various appropriate emotions were attributed to story characters – sadness, anxiety, annoyance and fear – but only by those children who achieved 1st or 2nd order theory of mind ability. No child in the 1st and 2nd order groups failed to attribute emotions in their responses to the social reasoning task. Although children in the no ToM group occasionally mentioned emotions, it was much less frequently than the other two groups, and they were mainly wrong in the given context (e.g. using "jealous" to describe how one boy would feel after having his favourite toy stolen). However, the simpler emotion of *liking* a favourite toy was frequently reported by children in all three groups.

Value Judgements

In this study, value judgements were statements that expressed an opinion about the correctness of a particular action or statements about rules of behaviour. Children in all three groups consistently identified “wrong” behaviour (“it was wrong to steal”; “shouldn’t have done that”), and also remarked upon rules that should not be broken (“should do as you’re told”; “should be in on time”). Only children with 1st or 2nd order theory of mind ability identified the breaking of a promise as “wrong” behaviour. Half of the children in these 1st and 2nd order groups identified this behaviour. Only children with 2nd order ability offered suggestions about when it may be acceptable to break a promise (e.g. “Mum may have had to work and so she couldn’t take Alan to the zoo as promised”). Only three of the 2nd order group made these suggestions.

Elaboration of Story

Only three children, who demonstrated 2nd order theory of mind ability, produced explanations for characters’ behaviour that elaborated on the contents of the original story. Examples of elaborations include: “Maybe the child had gone to see a film and it finished later than she thought and that was why she was late”; or, “Mum was annoyed because she was worried her daughter may have been kidnapped or killed”. Additionally, only children with 2nd order theory of mind ability (four out of the seven) identified the importance of how *both* characters’ feelings played a part in the action.

3.16 Social Reasoning and Social Skills

There were no significant differences in the mean total score of mentalist social skills shown by children in the different social reasoning groups ($J-T=1.627$, ns). There was a significant correlation between social reasoning level and total score of mentalist social skills shown in everyday life ($r=0.448$, $p<0.05$) which did not remain significant when correcting for verbal mental age ($r=0.341$, ns).

Nine out of the sixteen mentalist social skills were not performed by any child with only pre-reasoning social reasoning ability. In addition, the children in the pre-reasoning group did not perform any social skills in twelve out of the 23 non-mentalist clusters.

The types of responses given to social reasoning tasks were compared to the pattern of everyday social skills. Children who mainly reasoned about the social situations on the basis of rules (e.g. “shouldn’t take without asking”) showed few mentalist social skills in everyday life. These children were in the no ToM or 1st order ToM groups. One child in 1st order group used the same strategy to answer most of the social reasoning situations. This child identified the main protagonist as being “sad” and reasoned that the characters who had made the protagonist sad would “get into trouble”. This strategy, although appropriate in the contexts, was used for four out of six questions. This child performed very few mentalist social skills in everyday life.

Children who frequently referred to story characters’ emotions performed many of the mentalist social skills in everyday life. Children who referred to rules in relation

to story characters' emotions (e.g. "getting home late was bad because Mum would be worried"), rather than as concrete or inflexible constructs (e.g. "shouldn't be late"), showed the most mentalist social skills.

Children who used a variety of social reasoning strategies showed a greater amount of mentalist social skills in everyday life. These children were mostly in the 2nd order group. Children with 1st order ability tended to use just one or two types of responses (mainly emotions and value judgements/rules). However, the children with 1st order ability who did use a variety of responses also showed a great amount of mentalist social skills in everyday life.

CHAPTER 4: DISCUSSION

4.1 Summary and Discussion of Results

Throughout this section experimental hypotheses will be referred to where appropriate by their number (A1, B3, etc).

Theory of Mind

The participants were preselected to have a high chance of passing classic theory of mind tasks. Minimum chronological and verbal mental ages were set as criteria for inclusion in the study to ensure relatively high numbers of children who would demonstrate theory of mind ability. As a result, 76% of the participants passed both 1st order tasks and 41% passed both 2nd order tasks. These proportions of autistic children who can pass theory of mind tasks are significantly different from the proportions in the original studies of theory of mind ability in autistic children (20% pass 1st order in Baron-Cohen et al, 1985; 0% pass 2nd order in Baron-Cohen, 1989b). The participants in this study had similar mean chronological ages, but higher verbal mental ages, than the participants in Baron-Cohen et al's (1985) study, which could explain some of the differences in 1st order ability. However, the participants in this study had lower mean chronological ages and very similar mean verbal mental ages to Baron-Cohen's (1989b) study, and yet still performed more successfully on 2nd order theory of mind tasks. It therefore seems unlikely that age or verbal ability factors could account for the higher 2nd order ability seen in the current study.

53% of autistic children who passed 1st order tasks in this study also passed the 2nd order tasks. This proportion is very similar to the proportion of participants in Tager-

Flusberg & Sullivan's (1994b) study, where 58% of participants, who had been selected for the study because they had previously passed a 1st order task, passed the 2nd order task. The mean chronological and verbal mental ages of the participants in Tager-Flusberg & Sullivan's (1994b) study were also very close to those of the current study.

Justifications to 2nd Order Theory of Mind Tasks

The pattern of justification responses to the Ice Cream Van Story in this study were different to those discussed by Bowler (1992), in that fewer responses in the current study centred on the point in the story at which the false belief is set up. Only three out of the seventeen participants gave this type of justification, in comparison with the majority of Bowler's (1992) participants. Also, two of the participants gave (correct) 2nd order mental state justifications and three gave (incorrect) 1st order mental state justifications, whereas only one autistic participant of Bowler's (1992) study gave a mental state response (1st order).

As none of Baron-Cohen's (1989b) autistic participants passed the 2nd order false belief task, no comparison of justifications can be made with those who were successful in the current study. Of those who failed in Baron-Cohen's (1989b) study, half of the children used inappropriate 1st order justifications and the rest focussed on the physical aspects of the story ("the van is at the church"). Both of these types of response were also seen in the children who failed the task in the present study. Although the current participants were more successful at passing the false belief tasks than Baron-Cohen's (1989b) participants, they used fewer mental state

justifications than the normal and Down's syndrome controls who passed the task in Baron-Cohen's (1989b) study.

The pattern of justification responses to the Birthday Puppy Story in this study was similar in some aspects to those found by Tager-Flusberg & Sullivan (1994b). Similar proportions of participants used 2nd order justifications or focussed on information communicated in the story. 41% in the current study and 43% in Tager-Flusberg & Sullivan's (1994b) study centred their justifications on the deception being employed in the story. However, in the current study more than half who did so actually failed the task (because they answered a control question incorrectly), in contrast with Tager-Flusberg & Sullivan (1994b). More children in the current study failed to give any justification for their response.

Although the two 2nd order tasks are not directly comparable, some participants appeared to use similar strategies to answer both tasks. The children who gave 2nd order mental state explanations to the Ice Cream Van Story also gave mental state justifications to the Birthday Puppy story. Most children who failed to give a justification to either false belief question failed to give one to both. The strategy of focussing on the information given to characters in the story was more likely to be successful in the Birthday Puppy Story than the Ice Cream Van Story, but children tended to stick with the same strategy. As participants were given no feedback about the success or failure of their strategies, it is likely that they would stick to the strategies they believed to be appropriate.

The inconsistency between studies in the numbers of autistic participants able to pass false belief tasks is also relevant to the question of how central a theory of mind deficit is to autistic spectrum disorders (Sparrevohn & Howie, 1995). If other general factors such as language ability are having a significant impact on theory of mind performance, then the influence of language abilities and deficits in autism and the relative impact of theory of mind and language need to be examined in greater detail.

Theory of Mind and Strange Stories

The analysis of the data did not provide evidence to support the hypothesised relationships between theory of mind performance and the use of mental state terms in Justifications in the Strange Stories (A1). Children who did not pass theory of mind tasks used mental state terms in their Justifications (A2), suggesting that mental state terms can be used without an ability to reason about mental states.

The results from the current study were very similar to the pattern of results in Happé (1994). The mean and range of different categories of responses (correct mental; correct physical; incorrect mental; incorrect physical) were almost identical to those found in Happé (1994), where larger numbers of correct mental state terms were used by autistic children with higher order theory of mind levels, but all groups used similar levels of mental state terms in general.

One important difference between the current study and Happé (1994) was that the range of (i) total number of correct Justifications and (ii) number of correct mental

Justifications overlapped between the three theory of mind groups. The children in the no-ToM group performed no differently from the 1st order group in these areas, and both groups were less able than the 2nd order group in the current study. Happé (1994) had suggested that the lack of overlap between the three theory of mind groups in her study supported the validity of classic theory of mind tasks: differences in performance on classic theory of mind tasks “reveal real underlying differences in the ability to attribute mental states correctly in a variety of tasks (pg. 138)”. The current data do not support this claim.

A positive correlation was found between the *correct* use of mental state terms and theory of mind. The use of mental state terms correctly in the context indicates some ability to reason about mental states. Children in all theory of mind groups used some mental state terms correctly (A3, A4). Several children in the 1st order ToM group used just one or two mental state terms to answer several of the questions (e.g. “he’s lying” or “she’s joking”). This is suggestive of a learned strategy being used regardless of the actual social problem, or may indicate an understanding of a limited set of mental states.

Non-autistic children use mental state words such as *want*, *know* and *think* from a very early age, but initially use such terms in idiomatic ways (e.g. “I don’t know”). The current data is suggestive of this developmental stage of language acquisition. Perhaps with greater age and experience such idiomatic strategies can be used in more complex ways by children with autism who do not, for some reason, move on

to the next developmental stage of using mental state terms to refer to psychological states.

Both these possibilities – a genuine understanding of a limited set of mental states or idiomatic use of mental states with little understanding – would be consistent with the responses of one of the children in the no ToM group.

Four out of seven correct uses of mental states for one child in the no ToM group involved the mental state of desire (“he wanted to...”). Baron-Cohen (1991) found that the mental state of desire was one of the earliest to develop in children with autism, before the mental state of belief. It would be interesting to assess this child at a later date to examine if any further development in theory of mind had occurred (including belief), or whether reasoning about people’s actions in terms of their desires was a strategy learned without a real understanding of mental states. The correct use of mental state terms could demonstrate an understanding of these terms, or could be related to good verbal ability and a sophisticated general reasoning strategy for dealing with social problems.

Children with 2nd order theory of mind ability were more likely to use mental state terms correctly (A4). A wider set of mental states was used by this group and could be applied when appropriate. This suggests that some reasoning about mental states was occurring that perhaps facilitated the solving of false belief tasks. This would be consistent with the suggestion that flexible reasoning underlies success on theory of mind tasks (Zelazo, Burack, Benedetto & Frye, 1996).

Theory of Mind and Social Reasoning

There was support for the experimental hypothesis of a positive correlation between theory of mind performance and social reasoning ability (B1). Higher developmental levels of social reasoning were seen with increasing frequency in children with higher levels of theory of mind ability. There was no one-to-one mapping of social reasoning level to theory of mind level (B4, B5). The correlation between two different types of social reasoning task suggests that theory of mind ability is not separable from general social reasoning skills. In the current study, no child in the pre-reasoning group passed theory of mind tasks (B2) and no child who passed theory of mind tasks was at a pre-reasoning developmental stage of social reasoning (B3). This suggests that a general social reasoning deficit is related to theory of mind impairments in autistic children.

There is other evidence consistent with this finding. Zelazo, Burack, Benedetto & Frye (1996) found positive correlation between theory of mind and non-social reasoning and suggested that “difficulties in theory of mind may depend on more general difficulties in flexible reasoning (pg. 483)”.

The early social impairments found in children with autism are also consistent with the idea that a more general reasoning difficulty may influence theory of mind. Social interaction deficits appear in autistic children before age two (Baron-Cohen, Allen & Gillberg, 1992), yet theory of mind only appears to develop at about age three or four in normal children (Wimmer & Perner, 1983). This suggests that an

early general social reasoning impairment detrimentally affects later theory of mind development.

Klin, Volkmar & Sparrow (1992) found some early-emerging (before eight months of age) social deficits in children with autism. The behaviours that were absent in the autistic participants are typically present in normally developing infants before the time at which theory of mind skills are thought to develop. Their data were consistent with the suggestion that social impairments in autism occur early in social development and are not limited to only those behaviours that require a theory of mind. Klin et al (1992) qualified their conclusions by suggesting that there may be two subgroups of children with autism: those for whom a general social impairment is primary, and those for whom a theory of mind deficit might be primary.

These results conflict with Baron-Cohen's (1988, 1994) suggestion that theory of mind is central to and underlies social and communication development. The theory of mind hypothesis implies that social deficits in autism result from a failure to develop mentalising skills and therefore, social development should proceed normally until that stage in development when (non-autistic) infants develop a theory of mind.

Themes in Social Reasoning and Theory of Mind

Analysis of the responses to social reasoning questions confirmed the association between the correct use of mental state terms and theory of mind ability found with the Strange Stories. Although children in the no ToM group spontaneously used

mental state terms in their answers in the social reasoning task (B6), they were likely to be incorrect in the context. Children with 1st or 2nd order theory of mind ability demonstrated some understanding of the mental state terms they used, in that the terms were correct in the given context, and sometimes children in the 2nd order group appropriately elaborated on the original story (B7).

The differences between the theory of mind groups' use of mental state terms were not due to different verbal abilities. One child in the no ToM group used physical state terms accurately, but used mental state terms rarely and those were mainly wrong in the context. Another child, with 1st order ability, consistently used mental state terms in his reasoning about social situations. A third child, who had 2nd order ability, not only frequently used mental states when reasoning about social situations, but also elaborated on the original story, adding further information about people's motivations and emotions. All of these children had a verbal mental age of eight years and eleven months.

Despite the variety of appropriate responses and some demonstration of an understanding of mental states, all of these children had severe social deficits in everyday life. The reasoning about social situations displayed in "laboratory" conditions was not reported in everyday social interactions.

Theory of Mind and Social Skills

Frith and colleagues (Frith et al, 1994; Fombonne et al, 1994; Hughes et al, 1997) and Dawson & Fernald (1987) found evidence consistent with Baron-Cohen et al's

(1985) claim that children with autism who pass theory of mind tasks will show a different pattern of social skills and deficits than those who fail such tasks. They found that some social behaviours which appeared to require mentalising ability were related to theory of mind performance in individuals with autistic spectrum disorders.

In contrast, Sparrevohn & Howie (1995) and Prior et al (1990) found no correlation between theory of mind performance and everyday social behaviour.

The current study found evidence of an association between total scores for mentalist social skills and theory of mind performance. However, when examined individually, very few individual social skills clusters or items from the Vineland Adaptive Behavior Scales were positively correlated with theory of mind ability. Only two of the items judged as requiring theory of mind ability showed such an correlation. These two social skills (controls anger at constructive criticism; apologises for unintentional slights) were seen only in children with 1st or 2nd order ability (C2), suggesting that theory of mind ability may be required to perform these skills in everyday life. Another two mentalist social skills were also only seen in children with 1st order ability or higher (apologises for mistakes/errors in judgement; imitates a complex task several hours later). Although an apology can be made without feeling remorse, the social convention of apologising to avoid conflict needs to be learned from experience of social situations. Many of the children in this study could and did apologise *when prompted by a parent*, possibly indicating some understanding of the social conventions involved, but only children with theory of mind ability apologised appropriately and without prompting. This suggests that an

understanding of the situations that require an apology and the function of an apology in everyday life are associated with theory of mind ability.

However, the majority of mentalist social skills were also performed in everyday life by children who did not demonstrate any theory of mind ability (C1). There was therefore no support in this study for these social skills requiring theory of mind ability in order to be successfully performed.

There was also no support for the hypothesis that the three 2nd order social skills would only be performed by children with 2nd order ability (C3). In fact, children in all three theory of mind groups showed these social skills in everyday life. There were no social skills that were exclusively shown by children with 2nd order ability in this study.

Most of the items and clusters of behaviour in the Vineland Adaptive Behavior Scales involve interaction with other people. However, only very few of the items are about interactions with groups of people. It could be that 2nd order theory of mind ability is only necessary for group interactions, and that 1st order ability is sufficient for successful two-way interactions. 2nd order ability in everyday life may not be detected by the Vineland, and so no differences between the 1st and 2nd order groups would be detected.

Sparrevohn & Howie (1995) commented that it may be necessary to assess both theory of mind and social behaviour in real-world settings to detect potentially subtle

associations between the two. Classic theory of mind tasks may not be sensitive enough instruments to measure everyday understanding of mental states and measures of social skills may need to be specifically developed or validated for children with autism to detect evidence of such understanding (Sparrevohn & Howie, 1995). Items with more discriminable value with respect to theory of mind in autism may need to be developed.

Autistic individuals vary extensively in the range and severity of social dysfunctions and some social skills do develop (sometimes as the result of intensive intervention). This makes the prediction from the theory of mind hypothesis that only certain social skills related to mentalising ability will be impaired in children with autism a complex issue. Real relationships between theory of mind and everyday social skills could be hidden by these factors and hence few associations found for individual social behaviours with theory of mind as in the current study. In addition, judging which social skills are unequivocally mentalist is difficult because there are many other routes to acquiring a social skill, such as rote learning or conditioned responses to proscribed situations.

Strange Stories and Everyday Social Skills

There was some support for the hypothesised experimental relationship between the use of mental state terms in Justifications and the performance of mentalist social skills in everyday life (D1). Autistic children who used Moderate levels of mental state Justifications achieved higher mean total scores on the set of mentalist social skills than children in the Low use group. There was a slightly stronger correlation

between the use of *correct* mental state Justifications and total score of mentalist social skills.

However, when examined individually, only a few individual social skills clusters or items from the Vineland Adaptive Behavior Scales were positively correlated with the correct use of mental state terms. Only children who used a moderate proportion of mental state terms in Justifications showed those mentalist social skills. All other social skills (both mentalist and non-mentalist) were shown by children with moderate and low use of mental state terms in Justifications (D2, D3).

Neither of the mentalist social skills that were correlated to theory of mind ability were also correlated to the use of mental state terms. This suggests that the two measures of mentalising ability either were not assessing the same type of ability or that different types of strategies were being used by the participants to solve the tasks. Either option poses some problems for the accurate assessment of mentalising ability in children with autism.

Social Reasoning and Everyday Social Skills

Although there were no significant differences found in mean scores on the set of mentalist social skills between the social reasoning groups, it was noticeable how many of the individual items were not performed by any child in the pre-reasoning group. Children in the pre-reasoning group scored zero (i.e. never showed the social behaviour or group of behaviours) for about half of the individual mentalist items and half of the non-mentalist clusters. A deficit in social reasoning ability appeared

more devastating to social performance in everyday life than a deficit in theory of mind ability. Children in the no ToM group scored zero for less than one-fifth of all items and clusters. This supports the suggestion that theory of mind ability is one part of general social reasoning. If this is true, it is impossible to have a theory of mind ability without also having social reasoning ability, but it is possible to have social reasoning ability and not show theory of mind. Fewer social skills were impaired when compared to theory of mind performance because not demonstrating a theory of mind does not mean there is no social reasoning ability.

There was some support for the experimental hypotheses about relationships between types of responses used on social reasoning tasks and everyday social skills. Children in this study who used mental state terms most often in social reasoning responses showed evidence of mentalist social skills in everyday life (E1). Children who were flexible in their consideration of social rules were also more likely to show mentalist social skills. Children who reasoned in concrete, physical and rule-bound terms showed fewer mentalist social skills in everyday life (E4). Children who had access to more than one social reasoning strategy, who could use different strategies for different questions but could also use more than one strategy to answer one question, were the most socially able of the participants.

Despite a range of theory of mind and social reasoning task performance, the children in the current study remained socially impaired in comparison to the non-autistic population. Performance on tasks in this study did not directly relate to

everyday social performance. Even the children with apparently sophisticated reasoning abilities at hand did not seem to apply these skills in everyday life.

‘Laboratory’ settings make the task of social reasoning easier – there is unlimited time to answer and no negative consequences of getting the answer wrong. It is possible that social reasoning could be learned by different, more cumbersome routes than in normal development, depending on intelligence and good verbal ability and motivation to learn.

Leslie and Roth (1993) suggested general reasoning ability compensates for impaired theory of mind ability. General reasoning abilities could, through practice and experience, be used to create social reasoning strategies that compensate for the intuitive theory of mind abilities of non-autistic children. These compensatory social strategies would appear later in autism because of the need for practice and experience, and hence the greater verbal ability and chronological ages generally seen in autistic children who pass theory of mind tasks. The association found in the current study, that a minimum level of social reasoning was required before theory of mind tasks could be solved, is consistent with the idea that reasoning abilities less specific than theory of mind can be used to solve theory of mind tasks, at least in ‘laboratory’ settings.

Leslie & Roth (1993) report a study that found an association between success on theory of mind tasks and attainment of Piagetian concrete operations. This was only the case for children with autism, as non-autistic children display theory of mind

ability two or three years before attaining the concrete operational stage of development. The association between social reasoning and theory of mind performance in the present study also adds support to this possibility of autistic children using general reasoning resources to pass theory of mind tasks.

4.2 Theoretical Implications

Baron-Cohen, Leslie & Frith (1985) claimed that deficits in theory of mind were unique to people with autism and accounted for the pattern of characteristic impairments in social behaviour and other abilities. However, in their original study, 14% of children with Down's syndrome also failed the theory of mind tasks. Other researchers have also found significant proportions of non-autistic individuals who fail such tasks. Zelazo, Burack, Benedetto & Frye (1996) found that 75% of adults with Down's syndrome failed false belief tasks, a performance significantly worse than the mental-age-matched non-learning-disabled controls.

Zelazo et al's (1996) findings of theory of mind task failure in a clinical group other than autism suggests that deficits in theory of mind can exist without an autistic pattern of social dysfunction. That the children in the current study largely showed similar patterns of social impairment regardless of theory of mind performance implies that deficits in social behaviour typical of autism can be seen in individuals who demonstrate theory of mind ability.

The findings of the current study of links between general social reasoning and theory of mind, and that a lack of social reasoning ability was a better indicator of

everyday social dysfunction than a lack theory of theory of mind ability, are inconsistent with claims that theory of mind is domain-specific (Leslie & Thaiss, 1992). Proponents of the theory of mind hypothesis have demonstrated that the reasoning deficit in autism is limited to cognitive rather than perceptual reasoning (Reed & Peterson, 1990) and is limited to social rather than logical reasoning (Scott & Baron-Cohen, 1996). Other researchers have found that theory of mind deficits may develop from general reasoning impairments such as an inability to solve problems that require shifting from one perspective to the next about an single construct (e.g. such as is required for card sort tasks) (Zelazo et al, 1996) or failure to reason flexibly (Ozonoff, Pennington & Rogers, 1991). The current data analysis does not provide evidence to support the claim that theory of mind is an ability that is entirely separate from other types of reasoning.

The current study has found evidence to suggest that the accurate measurement of theory of mind ability is confounded by numerous factors such as (i) verbal ability, (ii) several alternative strategies that can apparently be used to solve theory of mind tasks and (iii) evidence that mental state terms can be used without understanding, all of which cast doubt on the ability of classic theory of mind tasks to detect the ability to attribute mental states.

The data are consistent with a more complex picture of interactions between language, social reasoning, strategies that can approximate theory of mind ability and factors influencing the use of knowledge in the appropriate contexts. Certainly for the children who demonstrated 2nd order theory of mind ability in this study, there

appeared to be evidence supporting the weak central coherence theory of autism (Frith, 1989).

The effects of weak central coherence could explain why some people with autistic spectrum disorders fail to show evidence of theory of mind ability in everyday life despite passing theory of mind tasks. This group of theory of mind “passers” may have knowledge of other people’s minds and mental states, but fail to apply that knowledge effectively at the appropriate time due to “local” level processing. For example, a literal understanding of language is a common feature of autistic-spectrum disorders. Local level processing of a conversation may focus on individual words, causing an autistic individual to miss the speaker’s intended meaning that attention to the whole context would make clear. The knowledge is available to them, but in the social context is not recognised as relevant (Bowler, 1992; Frith & Happé, 1994).

However, the current study did not find evidence to support the idea of one cognitive ability or deficit underlying theory of mind task performance and demonstration of the understanding of mental states in everyday life.

4.3 Clinical Implications

Social Subtypes

Several attempts have been made to categorise various subtypes of autism to aid diagnosis and specify interventions. The three general patterns of social interaction of Wing & Gould’s (1979) study have been used to define three subtypes of autism

within the autistic spectrum: “aloof”, “passive”, or “active but odd”. Baron-Cohen et al (1985) proposed that different subtypes of social behaviour in autism would be related to performance on theory of mind tasks. Volkmar & Klin (1993) suggested that, given the wide range of social deficits of individuals with autistic spectrum disorders, some attempt should be made to identify which aspects of social development in autism are related to general developmental delay, and which aspects “remain uniquely impaired in autism throughout development” (pg. 48).

Several items of social behaviour were not performed by any of the autistic children across the age range in this study and were therefore likely to be related to a specific autistic deficit. Certain elements of conversational behaviour were rarely or never performed in this population: none initiated conversations of particular interest to others; none responded to hints or indirect cues in conversation. Only one child, who had been the subject of a rigorous behavioural programme to address this point, permitted conversations to continue without interruption. Items relating to friendships were also rarely seen: none of the children had a ‘best friend’ and only four attempted to make their own friends. Group activities, unless initiated by parents or school, were never seen in these autistic participants.

These deficits, common to all participants, were seen in a wide age range and were independent of verbal ability, social reasoning ability or theory of mind ability. The population in this study was small, restricted to high-functioning individuals who had been referred to a psychology or psychiatry service, so generalised conclusions must be made with caution. However, one implication for psychological intervention may

be that, along with individualised intervention programmes, programmes aimed at facilitating friendships and teaching basic conversation skills may be appropriate for general group interventions for people with autistic spectrum disorders.

Interventions for Autism

The current findings have some implications for the interventions for autism aimed at teaching theory of mind skills. Social skills interventions for children and adults with autism have, in recent years, incorporated the teaching of mentalising skills (e.g. Ozonoff & Miller, 1995) or have focussed entirely on increasing theory of mind skills (e.g. Gray, 1994; Hadwin, Baron-Cohen, Howlin & Hill, 1996; Hadwin, Baron-Cohen, Howlin & Hill, 1997). Although these studies were mainly successful at teaching people with autism to pass the theory of mind tasks used in the interventions, none of the studies reported successful generalisation to other tasks (different in structure from the instruction tasks) and settings.

The findings of the current study suggest that for perhaps only a very few children with high-functioning autism is a theory of mind deficit the only reason for social failure. It is more complicated, involving language skills and social reasoning abilities. Although it is tempting to think that a general intervention could address various individual social skills deficits, the current study found almost as many individual relationships between theory of mind performance and everyday social skills as there were participants in this study. Addressing theory of mind deficits alone to increase social adaptation may miss important aspects of an individual's presentation that are influencing everyday social performance.

4.4 Methodological Considerations.

Participants

As one of the aims of the study was to examine differences in social skills between children with 1st order and 2nd order theory of mind ability, the children were pre-selected to have a high chance of passing theory of mind tasks. One of the criteria for initial selection was therefore to have a verbal ability of 5 years of age or more. Unfortunately, this reduced the available population size for a group that is rare in the general population and few children were appropriate for inclusion in this study. However, the number of participants in this study was similar to sample sizes in similar studies.

The chance of not finding a relationship that actually existed between variables was higher than is desirable due to the low numbers in the current study. Given the large number of statistical comparisons made and the small sample size in the current study, there is some likelihood that what significant results were found were the result of chance. That previous research has drawn some strong conclusions on the basis of similar sample sizes leaves open the possibility of similar errors.

The participants in this study were not representative of the whole autistic spectrum. Only high-functioning, verbally able children participated, whereas up to 80% of autistic individuals function within the range of learning disabilities (Volkmar & Klin, 1993). It is therefore speculative to generalise the results found in the present study to children with autism with poor verbal ability and learning disabilities.

Theory of Mind Measures

The theory of mind measures used in this study have been developed and used by many researchers to examine theory of mind ability. However, these measures have not been validated, no test-retest reliability measurement has been done, and there is evidence that the success or failure on these tasks by autistic children can be influenced by the wording of the tasks (Bowler, 1992; Eisenmajer & Prior, 1991). The high association between success on these tasks and verbal ability only emphasises that the measures require a variety of skills and it is difficult to isolate one particular ability as being the sole reason behind success or failure. The right skill may be present in the autistic individual being studied, but they do not utilise that skill to solve the task for other reasons, such as lack of experience with those types of task. There is little proof that the theory of mind measures used in this study and commonly used in other studies of theory of mind ability are measuring actual mentalising ability. Therefore drawing conclusions as to why certain relationships between performance on these tasks and performance of skills in everyday life do or do not appear must be done with caution.

Importantly, one-off testing of theory of mind ability offers no information about whether a deficit reflects a deviance or a delay in the development of the ability.

The British Picture Vocabulary Scale (BPVS)

The BPVS was used as the measure of verbal ability in the current study as it has been extensively used in previous studies of theory of mind ability and would facilitate comparison with such studies. However, although a reliable and valid

measure, it is only a measure of receptive verbal ability rather than general language functioning or overall developmental level. As theory of mind tasks are language-based and associations have been found between theory of mind ability and verbal ability, a more comprehensive assessment of verbal ability, including verbal expressive ability, would be desirable. This would facilitate more accurate comparisons across different studies examining autistic populations or other clinical populations.

Few studies have examined other aspects of the verbal ability of their participants, such as comprehension of complex syntax or expressive verbal ability. As theory of mind tasks are verbally presented and most require verbal answers, aspects other than recognition of vocabulary are likely to be relevant to task performance. It is an area that empirical studies of theory of mind in autism will need to explore further to understand fully the role of language in theory of mind ability.

Measurement of Adaptive Behaviour

Only one person's rating (a parent's) of the child's adaptive functioning was obtained in this study. This made it difficult to determine whether there was any distortion or inaccuracy in the reports obtained and gave little indication of a child's functioning in different environments.

The Vineland Adaptive Behavior Scales has been shown to be more reliable than other measures of adaptive behaviour (Voelker, Shore, Hakim-Larson & Bruner,

1997) and is specifically designed for use with parents (Sparrow, Balla & Cicchetti, 1984).

However, there are consistent findings that parents report lower levels of adaptive behaviour than teachers (e.g. Szatmari, Archer, Fisman & Streiner, 1994; Voelker et al, 1997) or clinicians (e.g. Sholle-Martin & Alessi, 1988). In the current study, parental perception of autistic children's social functioning could have been influenced by comparisons with non-autistic siblings and peers (Voelker et al, 1997) and the effects of coping with a behaviourally demanding child, and thus ratings of adaptive behaviour lower than the child's actual performance may have been obtained. Alternatively, the home environment may possibly reduce opportunities for children to display better adaptive skills or for parents to observe adaptive behaviour. Both of these possibilities could obscure instances of everyday mentalist social behaviour, and thus explain to some extent the lack of relationship found between many aspects of social behaviour and theory of mind performance.

Derivation of Set of Mentalist Social Skills

There is a wealth of research and observational evidence of the specific social behaviours that are impaired in autism. Previous studies looking at the relationship between theory of mind and social behaviour used such evidence to derive sets of behaviours that seemed likely to require a theory of mind ability (e.g. Frith et al, 1994). In the current study, the items of social behaviour were judged using strict criteria with reference to the postulated influence of theory of mind and not diagnostic criteria for autism. This was an attempt to minimise the possibility that

any correlations found were due to the co-existence of characteristic features within the population being studied rather than an effect of the influence of theory of mind ability.

The items in the mentalist set of social skills were not matched for developmental level or difficulty. It is therefore difficult to determine whether these behaviours are characteristic of a different stage in development from the other clusters of social skills (Frith, Happé & Siddons) and direct comparisons were confounded by this.

4.5 Future Research

A desire to keep assessment time to a minimum in the current study precluded extensive cognitive testing of participants. However, in future research it would be essential to measure non-verbal cognitive abilities as well as a wider range of verbal abilities in order to assess the relative contributions of these factors to theory of mind performance in individuals with autism. It would also be essential to include measures of logical and general social reasoning ability and compare such ability with theory of mind ability in the same group of autistic individuals. The difficulties in gathering data from a large enough population of high-functioning autistic individuals probably preclude analysis of the relative impact of these various factors unless a national collaborative effort is made.

In order to examine the question of whether autistic social dysfunction is a result of a social reasoning or theory of mind *deficit*, or due to a failure in the *application* of such an ability, a reliable and valid measure of central coherence would need to be

used along with measures of theory of mind and social reasoning. A combination of measures examining these factors would provide important information about the causes underlying social deficits in autism.

Theory of mind ability should be examined in clinical populations other than autism, with social and cognitive profiles both similar to and distinct from autistic profiles, in order to examine how theory of mind deficits, independent of an autistic presentation, affect social and cognitive functioning. If other clinical populations consistently fail theory of mind tasks, this would indicate that theory of mind deficits in themselves cannot account for characteristic autistic impairments.

Longitudinal studies of the development of theory of mind, social reasoning and social skills throughout childhood, adolescence and adulthood in both non-autistic and autistic populations would provide valuable information about the interrelation of these factors. It would also be useful to assess social behaviour in more than one setting in order to get as full picture as possible of the range of social expression of the individual participants.

In the current climate of evidence-based practice, further research is required into the efficacy and effectiveness of theory of mind interventions for social skills deficits in autism. Treatments for a developmental disorder such as autism should be planned with developmental goals in mind (Rutter, 1999). Comparisons of relative effectiveness of theory of mind interventions to treatment programmes with a more general social reasoning focus, such as Carol Gray's "Social Stories" (1994), would

be essential to ensure interventions were targeting the relevant developmental factors for children with autism.

4.6 Conclusions

The results from the present study demonstrate that the relationship between theory of mind ability, social reasoning and social impairment in autism is more complex than many have thought or would wish. It is clear that success on theory of mind tasks does not prevent social deficits. It appears there is more than one route to theory of mind task success and more than one route to social dysfunction in autism. Only by comparing performance across a whole battery of language tasks, social reasoning tasks and theory of mind tasks will a more complete picture of the cognitive processes underlying social deficits in autism become clear.

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APPENDIX 1:

Table of non-mentalist and mentalist social skills

NO THEORY of MIND (Clusters)	1ST ORDER THEORY of MIND (Individual Items)	2ND ORDER THEORY of MIND (Individual Items)
Recognising Emotions	Imitates a relatively complex task several hours after it was performed by another	Participates in conversation involving both peers and adults, without monopolising it.
Identifying Others	Knows particular likes and dislikes of other	Keeps secrets as long as appropriate
Responding to Social Communication	Initiates conversations on topics of particular interest to others	Buys appropriate gifts
Friendship	Responds to hints or indirect cues in conversation	
Giving Gifts	Engages in elaborate make-believe	
Initiating Social Communication	Refrains from questions/statements that might embarrass or hurt others	
Co-operative Interactions	Makes secrets	
Belonging to Groups	Controls anger/hurt when plans changed	
Sharing & Co-operating	Controls anger/hurt when denied own way	
Watching TV	Controls anger/hurt at constructive criticism	
Following Games Rules	Apologising for hurting feelings	
Playing Games	Apologises for unintentional slights	
Beginning Group Activities	Apologises for mistakes/errors in judgement	
Hobbies		
Extracurricular Activities		
Using TV & Radio		
Going Place with Friends		
Following Rules		
Beginning Politeness		
Using Manners in Conversation		
Being Responsible for Time		
Borrowing & Returning		
Making & Keeping Appointments		

Appendix 1. Items and clusters of social behaviour from the Vineland Adaptive Behavior Scales (Dunn et al, 1982) judged to require 1st order or 2nd order theory of mind ability, or to be possible without such ability (no theory of mind).

APPENDIX 2:
Initial contact letter

Date: January, 1999

Dear Parent

Child's Name:

I am a clinical psychologist in my final year of post-graduate training, currently on placement with the Child Health Team at Pitcullen House, Murray Royal Hospital. As part of my doctorate in clinical psychology, I am at present carrying out a research project examining the association between social skills and "Theory of Mind" in children with autism. Dr Mike Field, Consultant Psychiatrist, and Mrs Kate MacGowan, Chartered Clinical Psychologist, have discussed this project with me and believe you may be interested in participating. Please find enclosed an information sheet that gives you some details of the project. If you would like any further information or have any queries or concerns, please contact me, Miss Lynn Buntin at Pitcullen House, Murray Royal Hospital, Perth, PH2 7EA, or telephone 01738-621151.

If you and your child agree to take part, your child will be asked to complete some simple tasks involving answering questions about people's thoughts and behaviour in short stories. I will also ask you to complete some short questionnaires about your child's social skills abilities.

If you wish, I will be pleased to give written or verbal feedback of your child's performance and advice, based on that performance, which may be used to guide any social skills training undertaken by either yourself or your child's school. Unfortunately, it will not be possible to offer individual treatment sessions for your child at this time.

If you wish to participate further in this study, please complete and sign the enclosed consent form, including a daytime contact number, and return it in the prepaid envelope provided. I will then contact you to arrange a meeting with you and your child.

Thank you for your assistance in reading about this study.

Yours sincerely

Miss Lynn Buntin
Trainee Clinical Psychologist

APPENDIX 3:
Information sheet

INFORMATION SHEET

We invite you to participate in a research project. We believe it to be of potential importance. However, before you decide whether or not you wish to participate, we need to be sure that you understand firstly why we are doing it, and secondly what it would involve if you agreed. We are therefore providing you with the following information. Read it carefully and be sure to ask any questions you have, and, if you want, discuss it with outsiders. We will do our best to explain and to provide any further information you may ask for now or later. You do not have to make an immediate decision.

- Children and adults with autism often have difficulties in social situations. One theory which tries to explain this problem puts this down to a difficulty in taking another person's point of view. This is sometimes called having a "Theory of Mind".
- In this study, we would like to look at your child's performance on "Theory of Mind" tasks, and compare this to your child's social skills abilities.
- This information may be useful in the future for targeting interventions that aim to remedy social skills problems to those who can best make use of them.
- In addition, the information gathered could shed some light on the thought processes underlying success or failure in social situations.
- Children within the autistic spectrum between the ages of 8 and 17 and their parents living in the Tayside area are being asked if they would like to participate in this study.
- If you and your child agree to take part, your child will be asked to complete some simple assessments involving answering questions about people's thoughts and behaviour in short stories. This should take about 1 hour. In addition, you will be asked to complete two short questionnaires about your child's social skills. This should take about 30 minutes.
- The assessments can take place either at Pitcullen House, Murray Royal Hospital, or I can arrange to visit your home or the school, whichever is most convenient for you and your child.

Participation in this study is entirely voluntary and you are free to refuse to take part or to withdraw your child from the study at any time without having to give a reason and without this affecting his/her future medical care or his/her relationship with medical staff looking after him/her.

- All information gathered during the study will be treated in confidence and only the researchers will have access to that information.
- If you wish to participate further in this study, please complete the attached form and return it in the prepaid envelope enclosed.

The Tayside Committee on Medical Research Ethics that has responsibility for scrutinising all proposals for medical research on humans in Tayside has examined the proposal and has raised no objections from the point of view of medical ethics. (Research records may be examined by monitors from the Tayside Committee on Medical Research Ethics.)

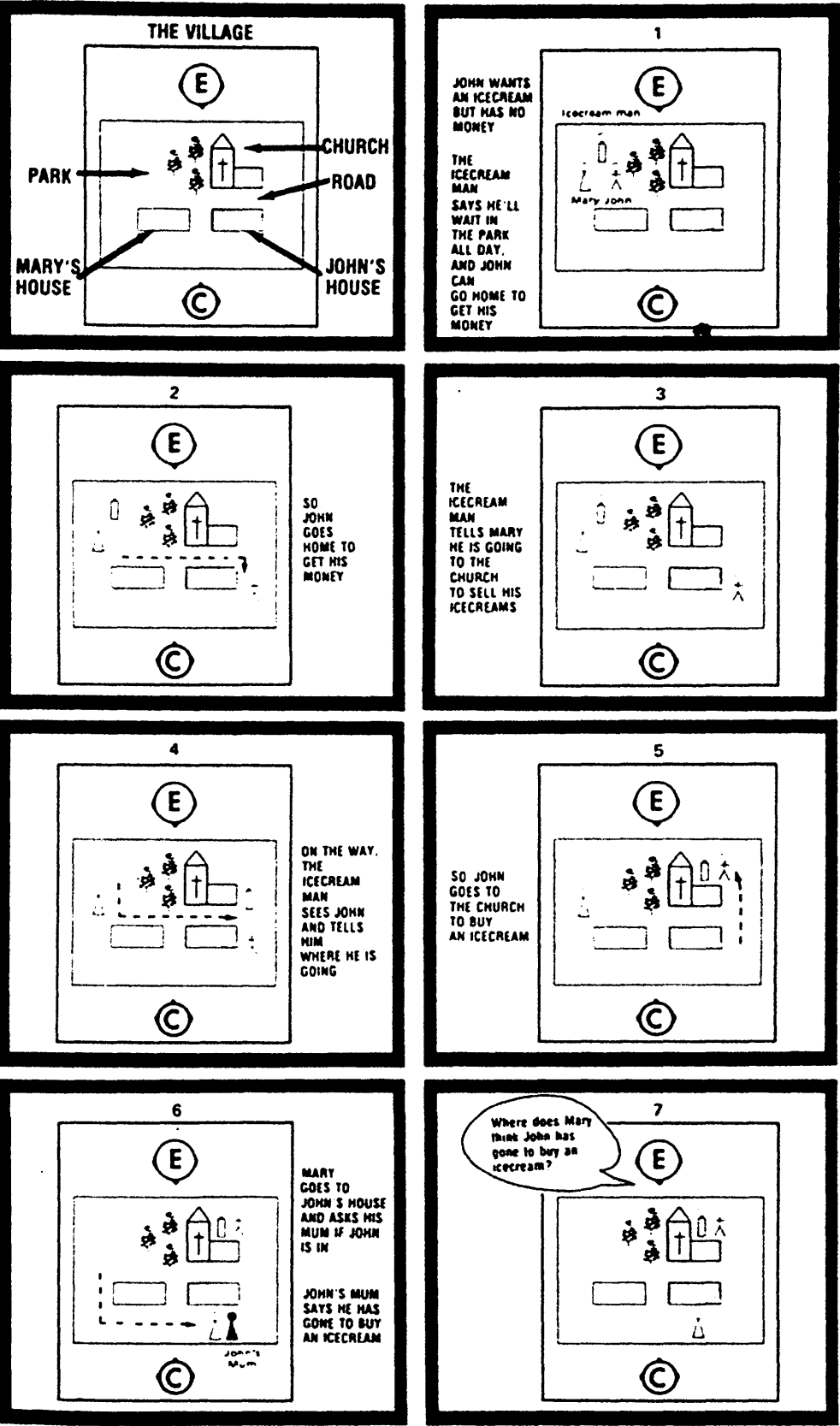
If you would like further information, please contact Miss Lynn Buntin, Pitcullen House, Murray Royal Hospital, Perth, PH2 7EA. Telephone: 01738-621151.

APPENDIX 4:

Scenario for the Ice Cream Van Story

(Baron-Cohen, 1989b)

Scenario for 2nd order theory of mind Ice Cream Van Story (Baron-Cohen, 1989a)



APPENDIX 5:

The Birthday Puppy Story

(Tager-Flusberg & Sullivan, 1994b)

2nd Order Theory of Mind Task: Birthday Puppy Story.

(Tager-Flusberg & Sullivan, 1994).

Tonight it's Peter's birthday and Mum is surprising him with a puppy. She has hidden the puppy in the garage. Peter says, "Mum, I really hope you get me a puppy for my birthday." Remember, Mum wants to surprise Peter with a puppy. So, instead of telling Peter she got him a puppy, Mum says, "Sorry Peter, I did not get you a puppy for your birthday. I got you a really great toy instead."

Reality Control Question: What did Mum really get Peter for his birthday?

Now, Peter says to Mum, "I'm going outside to play." Peter goes to the garage to fetch his bicycle. In the garage, Peter finds the birthday puppy! Peter says to himself, "Wow, Mum didn't get me a toy, she really got me a puppy for my birthday." Mum does NOT see Peter go into the garage to find the birthday puppy.

First-Order Ignorance Control Question: Does Peter know that Mum got him a puppy for his birthday?

Linguistic Control Question: Does Mum know that Peter saw the birthday puppy in the basement?

Now, the telephone rings, ding-a-ling! Peter's grandmother calls to find out what time the birthday party is. Grandma asks Mum on the phone, "Does Peter know what you really got him for his birthday?"

Second-order Ignorance Question: What does Mum say to Grandma?

Now remember, Mum does not know that Peter saw what she got him for his birthday. Then, Grandma says to Mum, "What does Peter think you got him for his birthday?"

Second-Order False Belief Question: What does Mum say to Grandma?

Justification Question: Why does Mum say that?

APPENDIX 6:

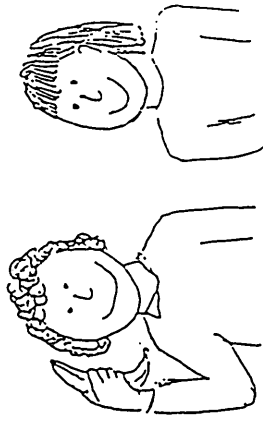
Strange Stories

(Happé, 1994)

Katie and Emma are playing in the house. Emma picks up a banana from the fruit bowl and holds it up to her ear. She says to Katie, "Look! This banana is a telephone!"

Is it true what Emma says?

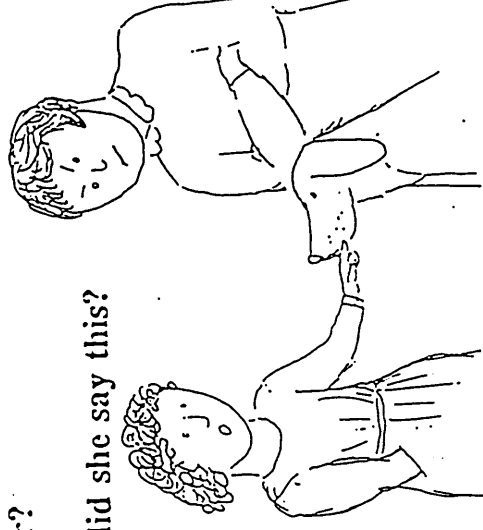
Why does Emma say this?



One day, while she is playing in the house, Anna accidentally knocks over and breaks her mother's favourite crystal vase. Oh dear, when mother finds out she will be very cross! So when Anna's mother comes home and sees the broken vase and asks Anna what happened, Anna says, "The dog knocked it over, it wasn't my fault!"

Was it true, what Anna told her mother?

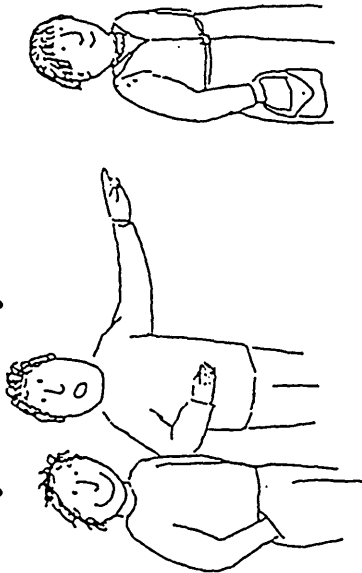
Why did she say this?



Daniel and Ian see Mrs. Thompson coming out of the hairdresser's one day. She looks a bit funny because the hairdresser has cut her hair much too short. Daniel says to Ian, "She must have been in a fight with a lawnmower!"

Is it true, what Daniel says?

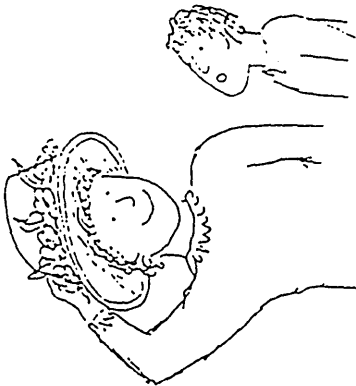
Why does he say this?



One day Aunt Jane came to visit Peter. Now Peter loves his aunt very much, but today she is wearing a new hat; a new hat which Peter thinks is very ugly indeed. Peter thinks his aunt looks silly in it, and much nicer in her old hat. But when Aunt Jane asks Peter, "How do you like my new hat?", Peter says, "Oh, its very nice".

Was it true what Peter said?

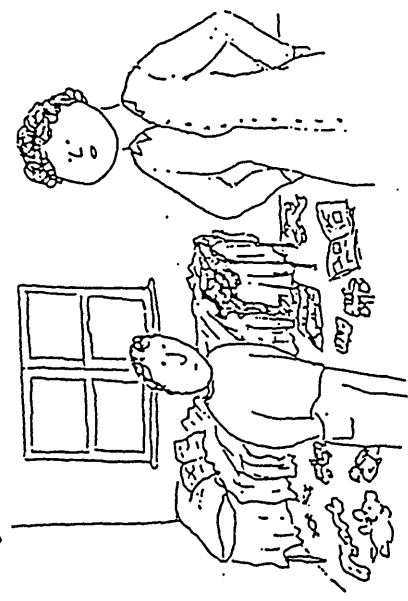
Why did he say it?



William is a very untidy boy. One day his mother comes into his bedroom, and it is even more messy than usual! There are clothes, toys, and comics, everywhere. William's mother says to William, "This room is a pig sty!"

Is it true that William keeps pigs in his room?

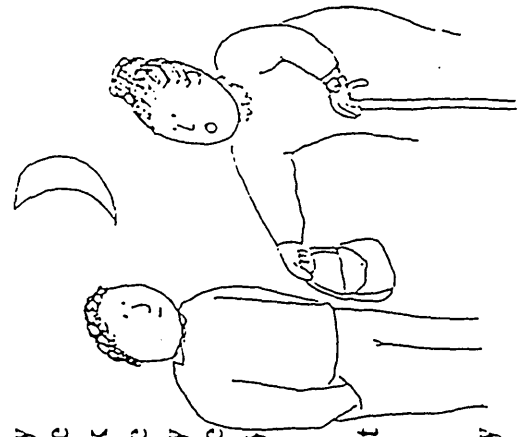
Why does William's mother say this?



Late one night old Mrs. Peabody is walking home. She doesn't like walking home alone in the dark because she is always afraid that someone will attack her and rob her. She really is a very nervous person! Suddenly, out of the shadows comes a man. He wants to ask Mrs. Peabody what time it is, so he walks towards her. When Mrs. Peabody sees the man coming towards her, she starts to tremble and says, "Take my purse, just don't hurt me please!"

Was the man surprised at what Mrs. Peabody said?

Why did she say that, when he only wanted to ask her the time?

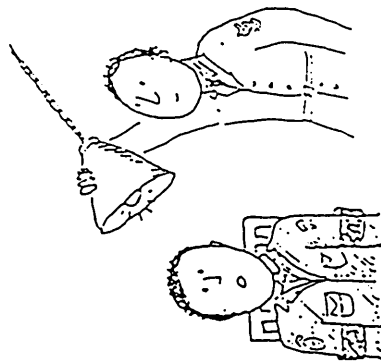


During the war, the Red army capture a member of the Blue army. They want him to tell them where his army's tanks are; they know they are either by the sea or in the mountains. They know that the prisoner will not want to tell them, he will want to save his army, and so he will certainly lie to them. The prisoner is very brave and very clever, he will not let them find his tanks. The tanks are really in the mountains. Now when the other side ask him where his tanks are, he says, "They are in the mountains".

Is it true what the prisoner said?

Where will the other army look for his tanks?

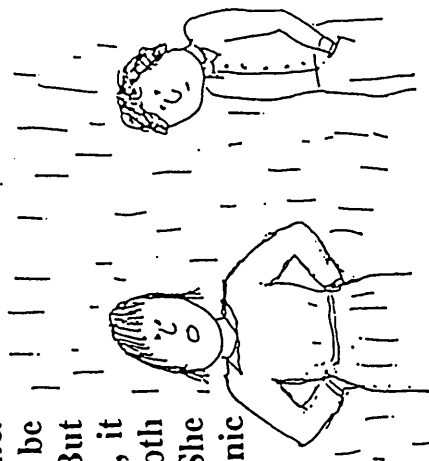
Why did the prisoner say what he said?



Sarah and Tom are going on a picnic. It is Tom's idea, he says it is going to be a lovely sunny day for a picnic. But just as they are unpacking the food, it starts to rain, and soon they are both soaked to the skin. Sarah is cross. She says, "Oh yes, a lovely day for a picnic alright!"

Is it true, what Sarah says?

Why does she say this?

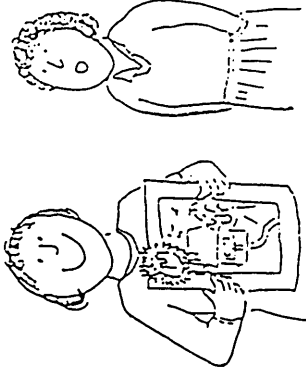


Jane and Sarah are best friends. they both entered the same painting competition. Now Jane wanted to win this competition very much indeed, but when the results were announced it was her best friend Sarah who won, not her. Jane was very sad she had not won, but she was happy for her friend, who got the prize. Jane said to Sarah, "Well done, I'm so happy you won!" Jane said to her mother, "I am sad I did not win that competition!"

Is it true what Jane said to Sarah?

Is it true what Jane said to her mother?

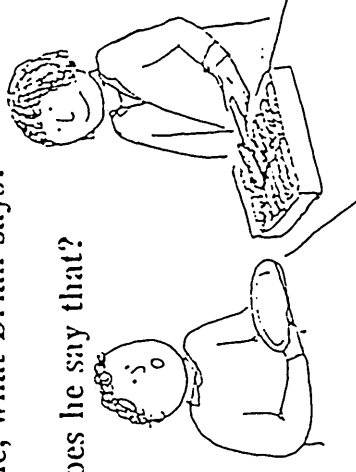
Why does Jane say she is happy and sad at the same time?



Brian is always hungry. Today at school it is his favourite meal - sausages and beans. He is a very greedy boy, and he would like to have more sausages than anybody else, even though his mother will have made him a lovely tea when he gets home! But everyone is allowed two sausages and no more. When it is Brian's turn to be served, he says, "Oh, please can I have four sausages, because I won't be having any tea when I get home!"

Is it true, what Brian says?

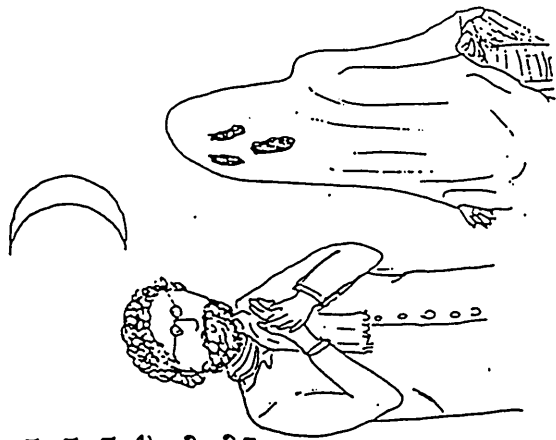
Why does he say that?



It is Halloween, and Chris is going to a fancy-dress party. He is going as a ghost. He wears a big white sheet with eyes cut out to see through. As he walks to the party in his ghost costume, he bumps into Mr.Brown. It is dark, and Mr.Brown says, "Oh! Who is it?" Chris answers, "I'm a ghost Mr.Brown!"

Is it true, what Chris says?

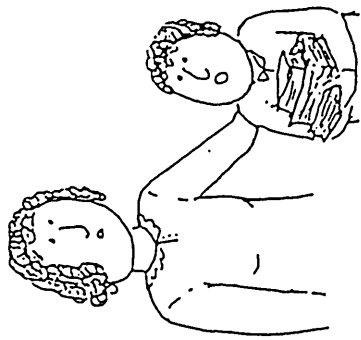
Why does Chris say this?



At school today John was not present. He was away ill. All the rest of Ben's class were at school though. When Ben got home after school his mother asked him, "Was everyone in your class at school today?" Ben answers, "Yes Mummy".

Is it true what Ben said?

Why did Ben say that?



APPENDIX 7:

Social Reasoning task

(Elliott, Murray & Pearson, 1978)

Social Reasoning

B.A.S.

I am going to tell you some very short stories about things that boys and girls have done. Each time I want you to tell me what you think about them and why. There are no right or wrong answers – all you have to do is say what you think.

1. John's ball was burst and it would not bounce, so John took Jane's new ball and played with that. What do you think will happen to John?.....Why?.....
2. Joe did not have many toys, but he had a teddy bear he loved very much. One day some older children took his teddy bear and burned it. They said it didn't matter. What do you think?.....Why?.....
3. Jane promised her mother that she would be home for nine o'clock, but she did not get home until midnight. Her mother was annoyed. What do you think about that?.....Why?.....
4. Alan's mother promised to take Alan and his friends to the zoo for a birthday treat. When it was Alan's birthday she said she was busy so they could not go. Do you think that was right?.....Why?.....
5. John Brown's mother likes to keep her house very clean and tidy. She is always telling John and his father to pick things up, put things away, take off their shoes, and so on. One day Mr Brown was so fed up with all this that when he was told to put his shoes away he threw them at his wife instead. What do you think of that?.....Why?.....
6. James' father had been away from home for a long time, and his mother was very sad. James wanted to give a really good present to cheer her up, but he didn't have much money, so one night he broke a shop window and took some things for his mother. Then he wasn't sure whether to give her the things or to get rid of them. What do you think?.....Why?.....
7. Colin and Dave like reading a lot, and Colin goes to the library every Friday. One week, Dave went with him and saw a lot of books he wanted to read. Colin showed him where to go to get tickets for the library but Dave said, "Not likely", and took the books he wanted out under his coat. What do you think?.....Why?.....

APPENDIX 8:

Vineland Adaptive Behavior Scales: Socialisation Domain

(Sparrow, Balla & Cicchetti, 1984)

ITEM SCORES 2—Yes, usually
1—Sometimes or partially
0—No, never
N—No opportunity
DK—Don't know

Note: During administration, record N or DK in the score column to represent a response of "no opportunity" or "don't know."
When computing cluster sums, count each N or DK as 1.

Interpersonal Relationships Subdomain

Survey Form
Item SCORE

Survey Form
Item SCORE

(1)

A. Beginning responsiveness

1. Looks at face of caregiver. 1
2. Responds to voice of caregiver or another person. 2
3. Follows with eyes a person moving at cribside or bedside.
4. Stops fussing when touched or picked up by caregiver.
5. Stops fussing when spoken to by caregiver.
6. Distinguishes caregiver from others. 3

SUM 12

(1)

B. Expressing emotions

1. Expresses two or more recognizable emotions, such as pleasure, sadness, fear, or distress. 5
2. Shows anticipation of being picked up by caregiver. 6
3. Smiles or vocalizes to make social contact. 7
4. Shows affection toward familiar people.

SUM 8

(2)

C. Responding to familiar people

1. Responds selectively to family or other familiar people.
2. Looks for familiar person when in need of attention.
3. Reaches for familiar person. 9

SUM 6

(3)

(4)

D. Imitating phrases and movements

1. Imitates simple adult movements, such as clapping hands or waving good-bye, in response to a model. 14
2. Imitates a relatively complex task as it is being performed by another.
3. Imitates a relatively complex task several hours after it was performed by another. 19
4. Imitates adult phrases heard on previous occasions. 20

SUM 8

E. Recognizing emotions

1. Shows desire to please caregiver. 17
2. Recognizes happiness, sadness, fear, and anger in others.
3. Labels happiness, sadness, fear, and anger in self. 24

SUM 6

(5) (6)

F. Identifying others

1. Addresses at least two familiar people by name. 16
2. Verbalizes interest in environment.
3. Says names of people seen only occasionally.
4. Identifies people by characteristics other than name, when asked. 25

SUM 8

(7) to (10)

G. Responding to social communication

1. Laughs or smiles appropriately in response to positive statements. 15
2. Responds verbally to social small talk initiated by adults.
3. Responds verbally and positively to good fortune of others. 31

SUM 6

H. Friendship

1. Shows a preference for some friends over others. 22
2. Makes own friends.
3. Has a preferred friend of either sex. 29
4. Stays overnight at friends' houses and has friends stay overnight.
5. Has a best friend of the same sex. 37

SUM 10

(11) (12)

I. Giving gifts

1. Knows particular likes and dislikes of others.
2. Asks parent or caregiver to buy gifts for others on special occasions.
3. Makes or buys small gifts for caregiver or family member on major holidays, on own initiative. 39
4. Remembers birthdays or anniversaries of immediate family members and special friends. 52

SUM 8

(13) to (18+)

J. Initiating social communication

1. Converses with others on topics of mutual interest.
2. Initiates social small talk when meeting acquaintances.
3. Initiates conversations on topics of particular interest to others. 53

SUM 6

Continue on the next page.

COMMENTS

COMMENTS

Note: During administration, record N or DK in the score column to represent a response of "no opportunity" or "don't know."
When computing cluster sums, count each N or DK as 1.

		Survey Form Item	SCORE
Play and Leisure Time Subdomain			
(1)	(1)		
A. Playing with toys			
1.	Plays with toy or other object alone or with others.	10	
2.	Plays very simple interaction games with others.	11	
3.	Plays with toy or other object for at least five minutes without breaking, pulling apart, or otherwise damaging it.		
4.	Uses common household objects for play.	12	
		SUM	8
(2)	(3)		
B. Interest in environment			
1.	Shows interest in novel objects or new people.	4	
2.	Shows interest in familiar toys or other objects.		
3.	Shows interest in children or peers other than siblings.	8	
4.	Moves to explore new situations.		
5.	Shows interest in activities of others.	13	
		SUM	10
C. Playing with others			
1.	Plays with others with minimal supervision.		
2.	Asks others over to play or goes to others' houses to play.		
3.	Participates in at least one game or activity with others.	18	
		SUM	6
(4)			
D. Make-believe activities			
1.	Uses common household objects or other objects for make-believe activities.		
2.	Engages in simple make-believe activities alone.		
3.	Engages in simple make-believe activities with others.		
4.	Engages in elaborate make-believe activities, alone or with others.	21	
		SUM	8
E. Sharing and cooperating			
1.	Shares toys or possessions with others when asked by caregiver.		
2.	Honors a simple bargain with caregiver.		
3.	Asks permission to play with or use a toy or object being used by another.		
4.	Shares toys or possessions without being told to do so.	26	
		SUM	8

Continue on the next page.

Continue on the next page.

COMMENTS _____

ITEM SCORES 2—Yes, usually
1—Sometimes or partially
0—No, never
N—No opportunity
DK—Don't know

Note: During administration, record N or DK in the score column to represent a response of "no opportunity" or "don't know." When computing cluster sums, count each N or DK as 1.

Survey Form Item	SCORE
5. Watching television	
1. Chooses between two television programs when asked. N MAY BE SCORED.	
2. Operates television independently. N MAY BE SCORED.	
3. Names one or more favorite television programs when asked, and tells on what days and channels the programs are shown. N MAY BE SCORED.	27
SUM	6

Survey Form Item	SCORE
6 to 9. Following game rules	
1. Takes turns while playing games, when asked.	
2. Plays simple group games in which someone wins but score is not kept.	
3. Takes turns while playing games without being reminded.	
4. Follows rules in simple games without being reminded.	28
SUM	8

Survey Form Item	SCORE
10 to 12. Playing games	
1. Plays simple card game.	
2. Plays simple board game based only on chance.	
3. Plays simple game which requires keeping score.	
4. Plays more than one board or card game requiring skill and decision making.	35
SUM	8

Survey Form Item	SCORE
1. Beginning group activities	
1. Goes places with friends.	
2. Goes places with friends during the day without adult supervision.	
3. Goes to evening school or facility events with friends, when accompanied by an adult. N MAY BE SCORED.	49
SUM	6

Survey Form Item	SCORE
13 to 14. Hobbies	
1. Collects and saves things.	
2. Trades possessions with friends.	54
3. Has a hobby.	
SUM	6

Survey Form Item	SCORE
15 to 18+. K. Extracurricular and nonschool activities	
1. Goes to extracurricular class or activity. N MAY BE SCORED.	
2. Participates in nonschool sports. N MAY BE SCORED.	57
SUM	4

Survey Form Item	SCORE
L. Using television and radio for entertainment and information	
1. Listens to radio for entertainment. N MAY BE SCORED.	
2. Watches television or listens to radio for information about a particular area of interest. N MAY BE SCORED.	48
3. Watches television or listens to radio for practical, day-to-day information. N MAY BE SCORED.	58
4. Watches television or listens to radio for news independently. N MAY BE SCORED.	60
SUM	8

Survey Form Item	SCORE
M. Going places with friends independently	
1. Refrains from frequently asking what to do.	
2. Does things with friends spontaneously.	
3. Plans ahead to meet friends.	
4. Goes to evening school or facility events with friends, without adult supervision. N MAY BE SCORED.	61
5. Goes to evening nonschool or nonfacility events with friends, without adult supervision.	62
SUM	10

Assign the highest possible sum to clusters before the basal.

PLAY AND LEISURE TIME RAW SCORE
(Total of cluster sums)

Continue on the next page.

COMMENTS

ITEM SCORES 2—Yes, usually
1—Sometimes or partially
0—No, never
N—No opportunity
DK—Don't know

Note: During administration, record N or DK in the score column to represent a response of "no opportunity" or "don't know."
When computing cluster sums, count each N or DK as 1.

Skills Subdomain

Survey Form Item	SCORE
Following rules	
Follows household or living unit rules.	30
Follows school or facility rules.	
Follows safety rules in recreational activities.	34
Follows community rules.	
SUM	8
Beginning politeness	
Says "thank you" when given something.	
Says "please" when asking for something.	23
Responds appropriately when introduced to strangers.	38
SUM	6
Using manners in conversation	
Participates in conversation involving both peers and adults, without monopolizing it.	
Permits conversation to continue without interruption.	42
Ends conversations appropriately.	
SUM	6
Being responsible for time	
Informs family, housemates, or caregiver of plans.	
Follows time limits set by caregiver.	43
SUM	4
Being sensitive to others	
Refrains from publicly commenting about physical abnormalities or ethnic attributes of others.	
Refrains from talking about personal family occurrences outside the home.	
Refrains from asking questions or making statements that might embarrass or hurt others.	44
SUM	6
Keeping secrets or confidences	
Keeps secrets or confidences for half an hour.	
Makes secrets or confidences.	
Keeps secrets or confidences for more than one day.	40
Keeps secrets or confidences for as long as appropriate.	46
SUM	8

G. Using table manners

1. Uses napkin to wipe face and hands during meals.
2. Chews food with mouth closed.
3. Says "please" when requesting that food be passed.
4. Does not talk with food in mouth.
5. Uses appropriate table manners without being told. DO NOT SCORE 1.

SUM

(11) (12)

H. Controlling impulses

1. Controls anger or hurt feelings when plans are changed for unavoidable reasons.
2. Controls anger or hurt feelings when denied own way.
3. Controls anger or hurt feelings at constructive criticism.
4. Independently weighs consequences of actions before making decisions.

SUM

(13) to (18+)

I. Apologizing

1. Apologizes for unintentional mistakes.
2. Apologizes for hurting feelings of others.
3. Apologizes for unintentional slights.
4. Apologizes for mistakes or errors in judgment.

SUM

J. Borrowing and returning

1. Returns borrowed toys, possessions, or money to peers, or returns borrowed books to library.
2. Repays money borrowed from caregiver.

SUM

K. Making and keeping appointments

1. Makes own appointments.
2. Makes and keeps appointments.

SUM

Assign the highest possible sum to clusters before the basal.

COPING SKILLS RAW SCORE
(Total of cluster sums)

Continue on the next page.

COMMENTS

APPENDIX 9:
Asperger Checklist

It would be most helpful if you could make an assessment as to whether your child stands out as different from other children of his/her age:

	No	Somewhat	Yes
1. Is old fashioned or precocious**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Is regarded as an “eccentric professor” by other children*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Lives somewhat in a world of his/her own with restricted idiosyncratic intellectual interests**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Accumulates facts on certain subjects (good rote memory) but does not really understand meaning*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Has a literal understanding of spoken and/or written language**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Has a peculiar style of communication with a formal, fussy, old fashioned or “robot-like” language*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Invents idiosyncratic words and expressions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. There is something odd about his/her voice or speech**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Expresses sounds involuntarily; clears throat, grunts, smacks, cries or screams	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Is surprisingly good at some things and surprisingly poor at others**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Uses language freely but fails to make adjustment to fit social contexts or the needs of different listeners*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Lacks empathy*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Makes naïve and embarrassing remarks**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Has a peculiar style of gaze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Wishes to be sociable but fails to make relationships with peers*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Can be together with other children but only on his/her own terms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Has no best friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. Lacks common sense*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Is poor at games: no idea of co-operating in a team, scores "own goals".**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Has clumsy, ill co-ordinated, ungainly awkward movements or gestures**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Has involuntary face or body movements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Has difficulties in completing simple daily activities because of compulsory repetition of certain actions or thoughts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Has special routines: insists on no change*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Shows idiosyncratic attachment to objects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Is bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Has notably unusual facial expression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Has notably unusual posture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please specify any problems other than above:
.....
.....
.....

Child's Date of Birth:.....

Date of Assessment:.....

Completed by:.....

APPENDIX 10:

Examples of answers to Strange Stories

Examples of Participants' Justifications to Strange Stories.

Answers Rated as Mental State Justifications

She's just pretending.

He doesn't want to upset her.

She thought he was a robber.

He wants to save his tanks.

He's greedy.

He knew they would think he was lying.

She's being sarcastic.

Answers Rated as Physical or Logical Justifications

He looks like a ghost.

So she doesn't get a telling off.

Because her friend won the competition.

Because it's a mess.

Because the rain came on.

Because the vase might be expensive.

APPENDIX 11:

Correlations between social skills and (a) theory of mind performance, (b) use of mental state terms and (c) social reasoning level.

Appendix 11. Correlation coefficients between mentalist social skill items and (a) theory of mind performance, (b) the use of correct mental Justifications on the Strange Stories and (c) social reasoning level.

Social Skill Item ("Mentalist")	Imitates complex task several hours later	Knows particular likes/dislikes of others	Chooses appropriate gifts	Initiates conversations on topics of particular interest to others†	Responds to hints/indirect cues in conversation†	Participates in conversation with peers and adults, w/o monopolising	Refrains from embarrassing/hurtful comments and questions	Makes secrets	Keeps secrets as long as appropriate	Controls anger when plans changed	Controls anger when denied own way	Controls anger at constructive criticism	Apologises for hurting feelings	Apologises for unintentional slights	Apologises for mistakes/errors in judgement	Correlation with Theory of Mind Score	Correlation with Correct Mental Justifications	Correlation with Social Reasoning Level
																-0.307	-0.788*	-0.183
																0.049	0.728*	0.479*
																0.204	0.558*	0.625*
																0.033	0.385	0.353
																-0.196	0.210	-0.157
																0.427	0.038	0.114
																0.205	0.487*	0.104
																0.130	0.379	-0.207
																0.271	0.424	0.388
																0.059	0.204	-0.112
																0.141	0.526*	0.111
																0.443*	0.432	0.149
																0.380	-0.169	0.514*
																0.510*	-0.034	0.229
																0.398	-0.143	0.625*

*correlation is significant at the 0.05 level

†social skill not performed by any participant

Continued...

Appendix 11 continued. Correlation coefficients between non-mentalistic social skill clusters and (a) theory of mind performance, (b) use of mental state terms in Justifications on the Strange Stories and (c) social reasoning level.

Social Skill Cluster (No ToM)	Correlation with Theory of Mind Score	Correlation with Correct Mental Justifications	Correlation with Social Reasoning Level
Recognising Emotions	0.348	0.505*	0.372
Identifying Others	0.161	0.613*	-0.062
Responding to Social Communication	0.202	0.575*	0.438
Friendship	0.241	0.332	0.534*
Giving Gifts	0.169	0.630*	0.385
Initiating Social Communication	0.097	-0.066	0.555*
Co-operative Interactions	0.771*	0.469*	0.283
Belonging to Groups	0.357	0.306	0.415
Sharing & Co-operating	0.611*	0.157	-0.009
Watching TV	0.334	0.000	0.160
Following Games Rules	0.282	0.095	-0.120
Playing Games	0.456*	0.223	0.196
Beginning Group Activities	0.185	0.159	0.137
Hobbies	0.304	-0.111	0.162
Extracurricular Activities	-0.026	0.254	0.187
Using TV & Radio	0.100	-0.081	0.284
Following Rules	0.410	0.081	0.331
Beginning Politeness	0.408	0.178	0.641*
Using Manners in Conversation	0.446*	0.155	0.015
Being Responsible for Time	0.277	-0.209	-0.165
Borrowing & Returning	0.038	-0.187	-0.076
Making & Keeping Appointments†	0.048	0.062	0.117

*correlation is significant at the 0.05 level

†social skills not performed by any participant